SANYO

Service Manual

CO_2 Incubator

FILE No.

MCO-18AC
MCO-18AC(UV)

SANYO Electric Co., Ltd.
Biomedical Business Division

SM9910236

Effective models

This service manual is effective for following models.

Name	Product code	Voltage and Frequency	
MCO-18AC	823 632 51	110~120V	60Hz
	823 632 52	220V	50Hz
	823 632 53	220V	60Hz
	823 632 54	220~240V	50Hz
	823 632 55	110~120V	60Hz
MCO-18AC(UV)	823 632 71	110~120V	60Hz
	823 632 72	220V	50Hz
	823 632 73	220V	60Hz
	823 632 74	220~240V	50Hz
	823 632 75	110~120V	60Hz

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Specifications

■Strucutural specifications

Name	CO_2 Incubator	
Model	MCO-18AC	MCO-18AC(UV)
External dimensions	W620 x D710 x H900 mm	
Internal dimensions	W490 x D523 x H665 mm	
Interior volume	170 L	
Exterior	Painted steel	
Interior	Stainless steel containing copper	
Outer door	Painted steel	
Inner door	Temperared glass	
Tray	3 trays, made of stainless steel containing copper Dimensions; W450 x D450 x H12 mm, Maximum load; 7 kg/tray	
Access port	Inner diameter; 30 mm, On the back side	
Insulation	Rigid-polyurethane foamed-in place	
Heating system	DHA system（Heater jacket and air jacket）	
Heater	282 W	
Humidifying system	Natural evaporation with humidifying pan	
Temperature controller	PID control system	
Temperature display	Digital display（Resolution: 0.1°C）	
CO_2 controller	ON-OFF control system / TC sensor	
CO_2 density display	Digital display (Resolution: 0.1%）	
Air circulation	Fan assisted	
Air filter	HEPA filter, 0.3μm, Efficiency: 99.97 % or more	
UV lamp	(Option)	4 W×1 (Ozone-free emission)
Water level sensor	(Option)	Optical type
Alarms	Automatic set temperature alarm, automatic set CO_2 density alarm, Upper limit temperature alarm, Door alarm, UV lamp failure alarm (UV type only) Low humidifying water alarm (UV type only)	
Remote alarm contact	Allowable contact capacity: DC 30 V, 2 A	
CO_2 inlet connection	Diameter; 4～6 mm tube can be connected	
CO_2 inlet pressure	0.03 MPaG	
Accessories	3 trays, 3 sets of tray support, 1 gas tube, 1 humidifying pan Stacking plate A and B, 2 protective stickers, 2 tube bands	
Weight	92 kg	93 kg
Optional accessories	UV system kit （MCO-18UVS3）	（Standard）
	UV replasement kit (MCO-20UV) Gas pressure regulator（MCO-100L） Extra tray（MCO-47ST）including 2 tray supports, Half tray（MCO-25ST）, Automatic CO2 cylinder changeover system（MCO-21GC） Roller base（MCO-18RB） 4-20mA Interface (MCO-420MA, USA only) RS232C/RS485 Interface (MTR-480), Ethernet (LAN) Interface (MTR-L03) SANYO Data acquision software (MTR-5000)	

■Control specifications

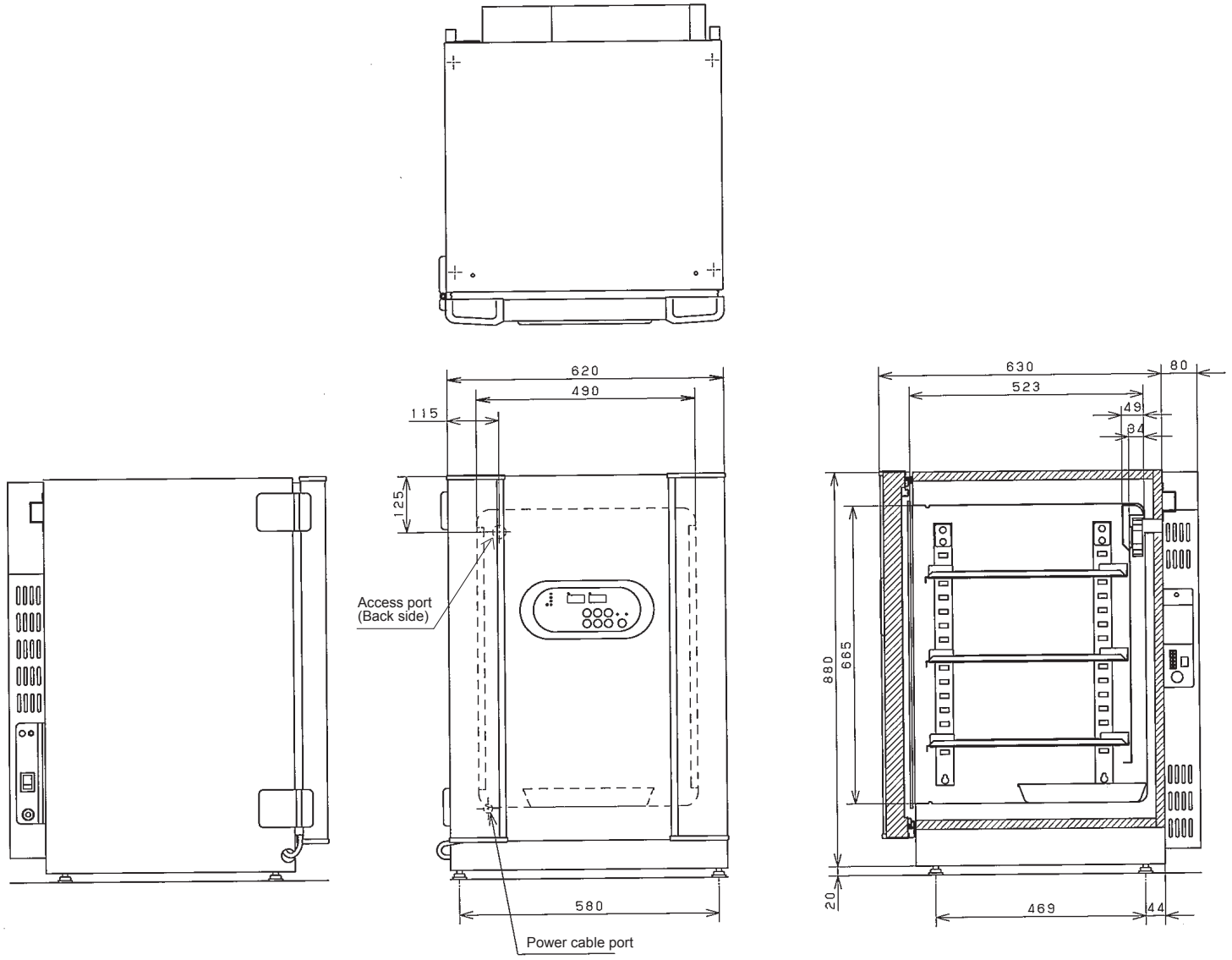
Model	MCO-18AC	MCO-18AC(UV)
Thermal sensor	Thermistor	
Temperature display	LED digital display (Resolution: 0.1℃)	
CO_2 controller	Microcomputer; Input by keypad CO_2 density setting range: 0%～20%（Resolution; 0.1%） Non-volatile memory	
CO_2 density display	LED digital display (Resolution; 0.1%)	
Water level detection	(Option)	Water sensor（Optic type）
Key lock function	Settable by pressing digit shift key for 5seconds	
Self-diagnosis functions	- Error code and chamber temperature are displayed alternately. - Remote alarm contact activates with buzzer sounds.	
Power switch	Installed on back side (Internal overcurrent breaker)	
Safety functions	- Heater turns off when upper limit temperature alarm is occurred or when temperature sensor is abnormal. - Valve is closed when CO2 sensor is abnormal. - Fan motor stops rotating when an outer door leaves open. (Except during CO2 calibration/measurement mode) - CO2 valve is closed when an outer door leaves open. - UV lamp goes off when an outer door leaves open.	
Control panel	UV indicator: Lights when UV lamp lights DOOR lamp: Lights when outer door is open RH PAN lamp: Blinks when humidifying water is less than 0.8L (when MCO-18UVS3 is optionally installed) OVER HEAT lamp: Lights when chamber temperature reaches upper limit temperature HEAT lamp: Lights when heater is energized INJECT lamp: Lights when CO2 gas is injected CO2 gas supply lamp A/B: Alternative lamp A or B lights when it is currently used either supply line A or B. SET: Setting key CAL: Calibration key BUZZER: Press this key to stop buzzer sounding ▶▶ : Digit shift key ▲: Numerical value shift key ENT: Enter key	

■**Performance specifications**

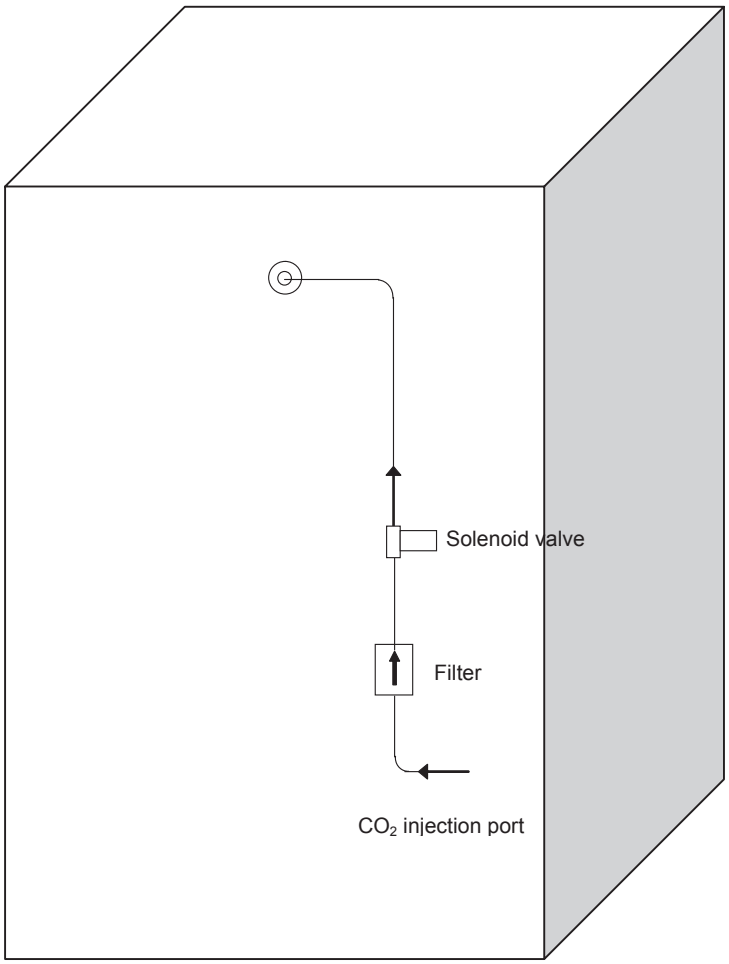
Model	MCO-18AC	MCO-18AC(UV)	
Temperature control range	Ambient temp. +5～50°C（ambient temp; 5～35°C）		
Temperature distribution	±0.25°C（ambient temp; 25°C、setting; 37°C, CO_2 5%, no load）		
Temperature variation	±0.1°C（ambient temp; 25°C、setting; 37°C, CO_2 5%, no load）		
CO_2 control range	0～20 %		
CO_2 variation	±0.15 %（ambient temp; 25°C、setting; 37°C, CO_2 5%, no load）		
Chamber humidity	95±5%R.H.		
Noise level	24 dB (A scale)		
Power consumption	Max.300W	Max.310W	
Rated voltage, frequency	110 to 120V, 60Hz	220V, 60Hz	220 to 240V, 50Hz
Amperage	Max.2.6A	Max.1.4A	Max.1.4A
Maximum heat emission	1116 KJ/h		
Usable environment condition	Temperature: 5～35°C, Humidity: Equal or less than 80%R.H. （Designed performance may not be obtained when ambient temp. is equal or lower than 15°C）		

Note) Specifications will be subject to change without notice.

Dimensions


620
490
115
125
Access port
(Back side)
580
Power cable port
630
80
523
49
84
880
665
20
469
44

CO_2 gas circuit



※ CO2 sampling should be done through the port on the inner door.

Temperature calibration

Note) Ensure to cancel Key Lock prior to commence calibration.

（1） Press CAL key for approx. 5 seconds.

（2） The 3rd digit on temperature display flashes and other digits will go off.

（3） Input current chamber temperature by pressing ▶▶ key and ▲ key.

（4） Press ENT key to return the device to chamber temperature display.

〔Example〕When a setting temperature is 37.0℃ and an actual measured temperature is 36.8℃;

① Press CAL key for approx. 5 seconds.

② “3” (The 3rd digit) on temperature display blinks and other digits will go off.

③ Input 36.8℃ by pressing ▶▶ key and ▲ key.

④ Press ENT key to return a device to chamber temperature display.

（Note）

* In temperature calibration, it is important to measure chamber temperature with accuracy. Ensure to measure center temperature of the chamber.

* Input range is within ±1.0℃ per calibration.
If a value which is out of the range is input, an error tone will emit and a device returns to chamber temperature display.

* When you change a value over than 1.0℃, it is necessary to calibrate temperature step by step.

Notes when the unit installation

When chamber temperature and humidity are not stabilized just after unit starting, there may be case that CO_2 density on CO_2 display is higher than actual density.
It is not abnormal because CO_2 sensor is heat-conducting type.

Set chamber temperature and set CO_2 to 0%, pour 1.5L distilled water into the humidifying pan.
Start and run the unit for approx. 8hours until chamber temperature and humidity will be stabilized.
Ensure to commence CO_2 zero and span calibration after chamber temperature and humidity stabilized.

CO_2 Span setting

Note) Ensure to cancel Key Lock prior to commence calibration.

Perform CO_2 calibration after you ensure chamber temperature and humidity are stabilized.

(1) Press CAL key.

(2) A unit steps into CO_2 calibration pre-conditioning mode. Circulating fan will activate if an outer door is open. Dot on CO_2 display will blink.

(3) Press CAL key for approx. 5 seconds.

(4) The 3rd digit on temperature display is flashing, other digits will go off.

(5) Press CAL key again.

(6) The 3rd digit on CO_2 display is flashing, other digit will go off. (CO_2 calibration input mode)

(7) Input a proper CO_2 density by using ⏩ key and ⏫ key and press ENT key.

〔Example〕If CO_2 setting is 5.0% and an actual measured value is 4.5%;

① Press CAL key.

② Press CAL key for approx. 5 seconds.

③ The 3rd digit on temperature display is flashing and other digits will go off.

④ Press CAL key again.

⑤ The 3rd digit on CO_2 display is flashing, other digits will go off.

⑤ Input “4.5” (4.5%) by using ⏩ key and ⏫ key.

(8) Press ENT key to return the device to chamber temperature display.

<Note>

1) If CO_2 density is less than 2.0% on CO_2 display, an error tone will emit to inform that the input data is invalid. Device automatically returns to chamber temperature display.
2) Prior to commence calibration, ensure to measure CO2 density for 3 times at least to avoid misdiagnosis.
3) Ensure capacity of CO_2 analyzer should be less than 0.2L injection/min.
4) Ensure to confirm chamber humidity should be more than 90% so that there should be no difference between actual CO_2 density and CO_2 display. Commence CO_2 calibration with 30 minutes delay after a door is open then closed.
5) When a chamber temperature deviates from set temperature -3℃, CO_2 calibration and measurement mode will be finished automatically. (Fan will stop activating when an outer door is open.)
6) If you press CAL key during a unit is in CO_2 calibration/measurement mode, a unit will start CO_2 calibration/measurement mode for another 5 minutes.
(A fan will activate if an outer door is open)

CO_2 calibration

Note) Ensure to cancel Key Lock prior to commence calibration.

<Prior to commence CO_2 zero calibration>

1. Ensure CO_2 is not present and the humidity is stabilized in the chamber.
2. Ensure CO_2 zero calibration should be performed before CO_2 is injected.
3. When CO_2 zero calibration is performed again, leave the outer door open to ensure CO_2 is not present in the chamber.

<Procedure>

1. Fill distilled water in a humidifying pan and set a temperature at 37℃ and set CO_2 density at 0%.

2. Run a unit for approx. 8hours until chamber humidity can reach 90% or higher.

Note) Do not open an outer door until chamber humidity is stabilized.
Chamber humidity will be stabilized after unit is running for approx. 5hours if an outer door is not opened.

3. When chamber temperature is displayed and press CAL key for approx. 5seconds to blink the 3rd digit on temperature display. Press ▲ key to display "F" in the 3rd digit.
Press ▶▶ key to display "0" in the 1st digit and "3" in the 1st decimal digit.
"F03" is displayed on temperature display.

4. Press ENT key to display "000" on CO_2 display.
Change the value to "384 " by using ▲ key and ▶▶ key.
Press ENT key to step to Function mode.

5. If there is condensation in a chamber, step to F06 by using ▲ key and ▶▶ key.
Current output ratio for humidifying heater is displayed on CO_2 display.
Change the ratio to lower value not to generate condensation.
(Ex.) When current output ratio for humidifying heater is "005", change the value to "004" or "003".
(Note) Ensure to change output ratio after wiping drips off.

6. If there is condensation on inner door glass, step to F07 by using ▲ key and ▶▶ key.
Current output ratio for door heater is displayed on CO_2 display.
Change the ratio to higher not to generate condensation.
(Ex.) When current output ratio for door heater is "005", change the value to "006" or "007".
(Note) Ensure to change output ratio after wiping drips off.

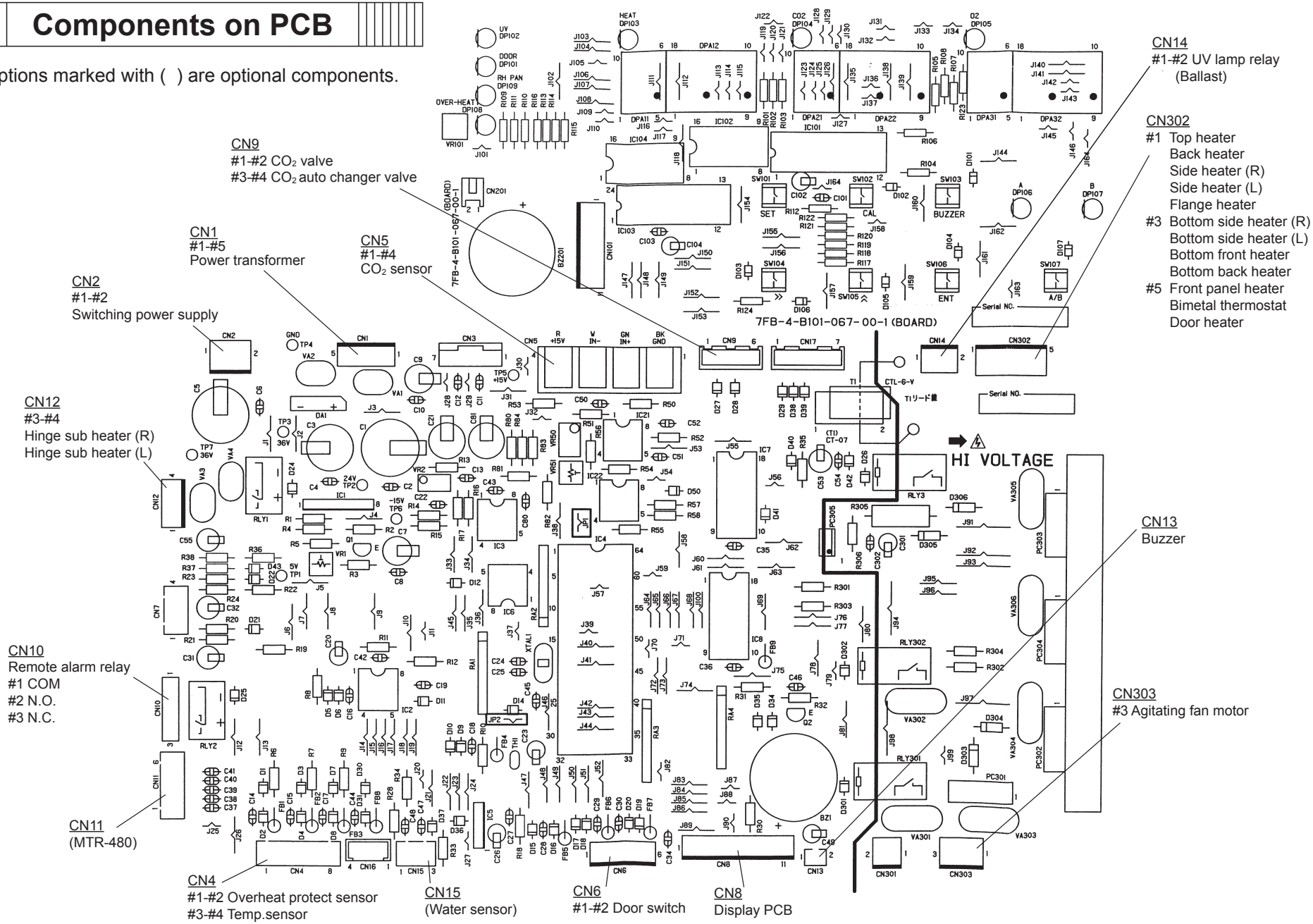
7. If a displayed chamber temperature does not match with setting temperature, commence temperature calibration.
(Ex.) When displayed temperature is 37.0℃ and actual chamber temperature is 36.7℃, press CAL key for approx. 5seconds. Change the value to "36.7" by using ▲ key and ▶▶ key. Press ENT key to finish temperature calibration.

8. CO_2 zero calibration
Press CAL key for approx. 5seconds to blink 3rd digit on temperature display.
Press CAL key again to blink digits on CO_2 display.
Change digits to "00.0" by using ▲ key and ▶▶ key.
Press ENT key to finish CO_2 zero calibration.

Note) Ensure to change service code from "384" to "000" after CO_2 zero calibration is finished.

Components on PCB

Descriptions marked with ( ) are optional components.



Connection on PCB

***Connections on Main PCB**

Connector	Connects to	Usage
CN1	Power transformer #1 -#2: AC8.5V #3: GND #4 and #5: AC18V	To supply the power to PCB.
CN2	Switching power supply ＃1－＃2（GND）: DC5V	To supply the power to PCB.
CN4	#1 - #2: Overheat protect sensor #3 - #4: Temperature sensor	To measure the temperature of each parts.
CN5	#1 - #2: CO_2 sensor	Input from CO_2 sensor
CN6	Door switch	To detect door opening.
CN8	Switch, Display PCB (CN101)	
CN9	#1 - #2: CO_2 valve #3 - #4: CO_2 Auto changer valve (Option)	To control CO_2 valve ON and OFF.
CN10	Remote alarm output #1- #2 Open during normal operation	Output of remote alarm contact
CN11	Communication board, MTR-480 (Option)	
CN12	#3 - #4: Hinge sub heater (R), (L)	
CN13	Buzzer	For alarm
CN14	UV lamp relay (Option for MCO-18AC)	To control UV lamp ON and OFF.
CN15	Water sensor (Option for MCO-18AC)	To check water level in humidifying pan.

***Connections on power PCB**

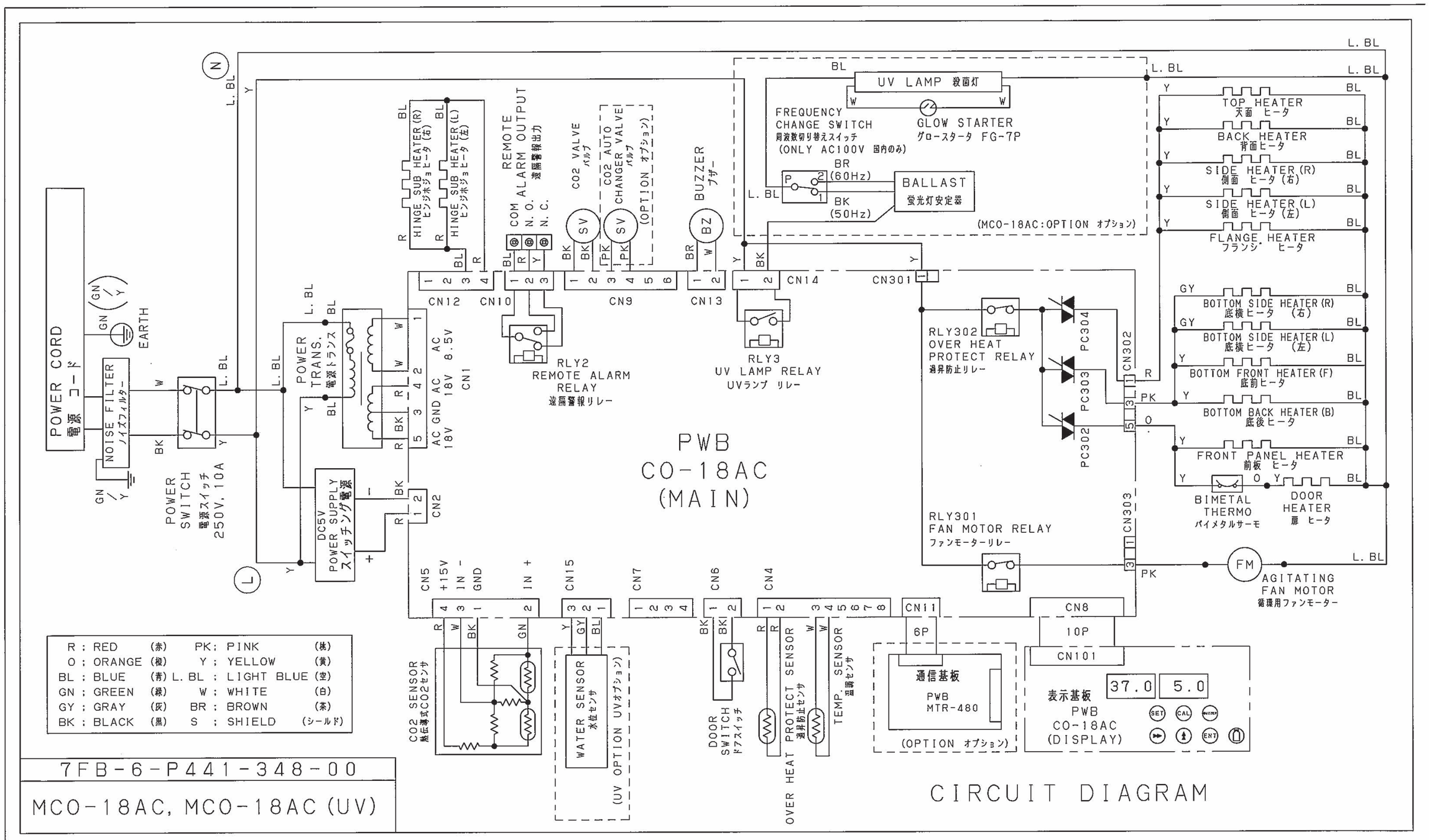
Connector	Connects to	Use
CN301	Main PCB	
CN302	＃1: Heater for heat control (5pcs) ＃3: Bottom heater (4pcs) ＃5: Front panel heater, Door heater (2pcs)	To control heater
CN303	＃3: Circulating fan motor	To control circulating fan motor.

Electric parts

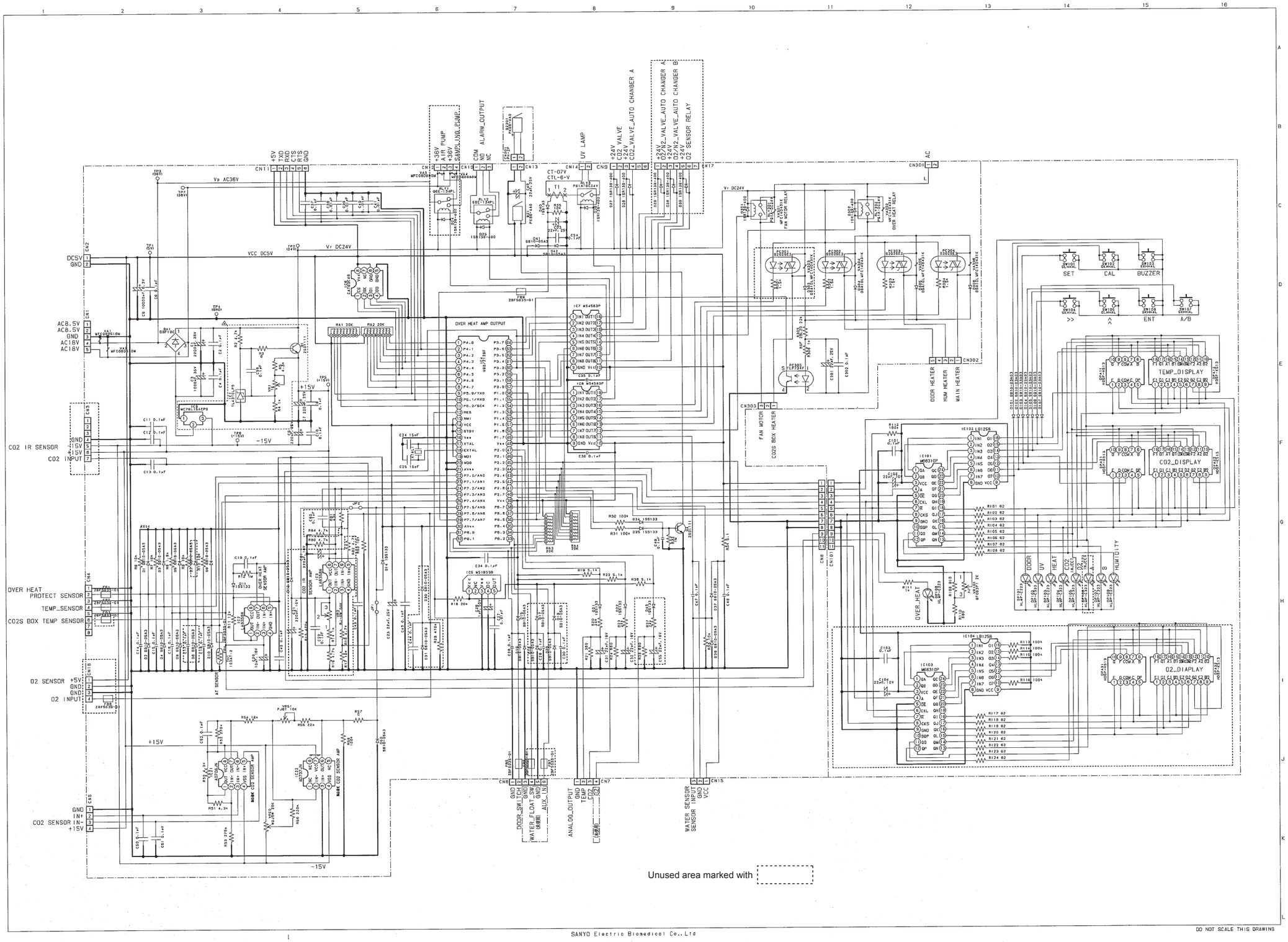
MCO-18AC/18AC(UV)		AC110-120V, 60Hz	AC220-240v, 50Hz	AC220v, 60Hz
CO_2 sensor	Type	HS-3C-S3	HS-3C-S3	HS-3C-S3
	Code	MIR-1000CO2	MIR-1000CO2	MIR-1000CO2
Temp. sensor	Type	103AT-1	103AT-1	103AT-1
	Rating	10KΩ(25℃)	10KΩ(25℃)	10KΩ(25℃)
Overheat protect sensor	Type	103AT-1	103AT-1	103AT-1
	Rating	10KΩ(25℃)	10KΩ(25℃)	10KΩ(25℃)
Circulating Fan motor	Type	FL2-011Y1MP	FL2-011Y5MP	FL2-011Y5MP
	Rating	110-115VAC	220-240V	220-240V
Power transformer	Type	ATR-HN231UT	ATR-HN235T	ATR-HN235T
	Primary	115V	230V	230V
	Secondary	8.5VAC ±18VAC	8.5VAC ±18VAC	8.5VAC ±18VAC
Top heater	Rating	115V 8W	230V 8W	230V 8W
	Resistance	1647Ω	6590Ω	6590Ω
Back heater	Rating	115V 12W	230V 12W	230V 12W
	Resistance	1104Ω	4415Ω	4415Ω
Side heater	Rating	115V 30W	230V 30W	230V 30W
	Resistance	441Ω	1763Ω	1763Ω
Flange heater	Rating	115V 31W	230V 31W	230V 31W
	Resistance	432Ω	1685Ω	1685Ω
Bottom front heater	Rating	115V 11.5W	230V 10W	230V 10W
	Resistance	1149Ω	5319Ω	5319Ω
Bottom back heater	Rating	115V 10.4W	230V 10.4W	230V 10.4W
	Resistance	1308Ω	5014Ω	5014Ω
Bottom side heater	Rating	115V 14W	230V 14W	230V 14W
	Resistance	945Ω	3779Ω	3779Ω
Front panel heater	Rating	115V 37W	230V 37W	230V 37W
	Resistance	353.7Ω	1460Ω	1460Ω
Door heater	Rating	115V 85W	230V 85W	230V 85W
	Resistance	156.9Ω	610.3Ω	610.3Ω
Hinge sub heater	Rating	36V 0.3W	36V 0.3W	36V 0.3W
	Resistance	4320Ω	4320Ω	4320Ω
Bimetal thermostat	Type	TH-2U	TH-2U	TH-2U
	Rating	60℃ ON, 70℃ OFF	60℃ ON, 70℃ OFF	60℃ ON, 70℃ OFF
CO2 valve	Type	FAB11-X2265	FAB11-X2265	FAB11-X2265
	Rating	DC24V	DC24V	DC24V
CO2 auto changer valve *1	Type	FAB11-X2265	FAB11-X2265	FAB11-X2265
	Rating	DC24V	DC24V	DC24V
Noise filter	Type	ZUG2210-11S	ZUG2210-11S	ZUG2210-11S
	Rating	250VAC 10A	250VAC 10A	250VAC 10A
Power switch	Type	BAM210131	BAM210131	BAM210131
	Rating	250VAC 10A	250VAC 10A	250VAC 10A
Door switch	Type	SS160-A15	SS160-A15	SS160-A15
	Rating	28V 50mA	28V 50mA	28V 50mA
DC 5V power supply	Type	ZWS15-5/J	ZWS15-5/J	ZWS15-5/J
	Primary	5VDC 3A	5VDC 3A	5VDC 3A
	Secondary	85-265VAC	85-265VAC	85-265VAC
Water sensor *2	Type	OLS-1003S	OLS-1003S	OLS-1003S
	Rating	DC5V	DC5V	DC5V
UV lamp *2	Type	GL4	GL4	GL4
	Rating	4W	4W	4W
Glow starter *2	Type	FG-7P	FG-7P	FG-7P
Ballast *2	Type	EKF-04115B1-P	EKD-0423A22B	EKD-0423A22B
	Rating	4W, 115V	4W, 220/230V	4W, 220/230V

<Components included in option kit> *1…CO2 auto-changer kit (MCO-21GC) *2 … UV lamp kit (MCO-18UVS3)

Wiring diagram



Circuit diagram



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DO NOT SCALE THIS DRAWING

Control specifications

1. Keys on Control panel

BUZZER: When an alarm LED is flashing and the buzzer sounds, Buzzer and remote alarm output keeps activating.

SET: Press this key to step to temperature setting mode.
Press this key two times to step to CO_2 level setting mode.
Press this key three times to step to check mode of overheat protect temperature.
Press this key four times to return to chamber temperature display.

▶▶: (Digit shift key) A digit will shift among 2nd digit, 1st digit and 1st decimal digit by pressing this key.
When chamber temperature is displayed, press this key for 5 seconds to step to Key Lock mode.

▲ : (Numerical value shift key) A numerical value will be changed by pressing this key.

CAL: In chamber temperature display, press this key for about 5 seconds to step to temperature calibration mode.
Press this key again to step to CO_2 calibration mode.
When the CO_2 is set in 0%, a device only steps to temperature calibration mode.
In temperature calibration mode, a device steps to Function mode if you input function code 'FXX' by pressing ▲ key and ENT key.

When a chamber temperature is stabilized (chamber temperature is within set temperature-3 ℃), press CAL key to enable a device to enter CO_2 calibration/measuring mode.
In CO_2 calibration/measuring mode, fan will not stop circulation if an outer door is opened. Dot on the CO_2 display will blink during this mode.
CO2 calibration/measuring mode will be finished automatically by buzzer sounding 3 times after 5 minutes elapse.
If CAL key is pressed again during CO_2 calibration/measuring mode, a device will restart this mode for another 5 minutes.

ENT: Press this key to store a setting value in setting mode, calibration mode and Function mode.

A／B: This key is available only when Auto-changer mode is set in F08.
Auto-changer mode is optional function.
In Auto-changer mode, press this key to switch a cylinder in use to alternative another one.
If one of A or B lamp illuminates, it means that cylinder A or B is in current used.
When a cylinder in used becomes empty, another cylinder is used in turn.
At that time, a lamp for cylinder which becomes empty starts flashing and another lamp for cylinder which is used in turn will illuminate.

2. Temperature control

Setting range:	0℃～＋50℃
Display range:	0℃～＋99.9℃
How to set chamber temperature:	Press SET key and set a value by pressing ▲▼ key and ▶▶ key. Press ENT key to store the value and the device steps to CO_2 setting mode.
Unacceptable setting range:	When a value which deviates from setting range is input and ENT key is pressed, buzzer sounds for 1 second and the previous value remains.
Control:	PID control
Temperature alarm:	When a chamber temperature deviates from setting temperature ±1℃, digits will flash and audible alarm sounds and remote alarm outputs after 15 minutes later.

3. CO_2 control

Setting range :	0%~20%
Display range :	0%~99.9%
How to set CO_2 level:	Press SET key two times. Set CO2 level by pressing ▲▼ key and ▶▶ key. Press ENT key to store the value and a device steps to Overheat protection temperature check mode.
Unacceptable setting range:	When a value which deviates from setting range is input and ENT key is pressed, audible alarm sounds for 1 second and the previous value remains.
Control:	ON-OFF control When CO_2 level is lower than setting value -0.06%, CO_2 control is ON. When CO_2 level is higher than setting value -0.01%, CO_2 control is OFF.
Control OFF:	When a setting value is 0.0%, CO_2 display will be blank and CO_2 level is uncontrollable.
CO2 alarm:	When CO_2 level deviates from setting value ±1%, CO_2 display will flash and audible alarm sounds and remote alarm outputs after 15 minutes later.

4. Overheat protection temperature check mode

Setting range :	35℃～51℃
Setting method :	Press SET key three times to display the overheat protection temperature on temperature display and “HI” on CO_2 display. Turn the volume, VR101 to adjust overheat protection temperature. Press SET key again to return to chamber temperature display.

5. Alarm, safety mode and self diagnosis

When malfunctions related sensors and CO_2 control are occurred, an error code and chamber temperature are displayed alternately.

Note) The remote alarm is controlled every minute exceptionally in Auto Zero performs, so there are 4 minutes of delay at maximum after an error code is displayed.

<Error code>

- E01: CO_2 cylinder becomes empty
- E05: Temp. sensor is open circuited
- E06: Temp. sensor is short circuited
- E09: AT sensor is open circuited
- E10: AT sensor is short circuited
- E11: CO_2 sensor output voltage is abnormal
- E12: Main heater is abnormal
- E13: Bottom heater is abnormal
- E14: Door heater is abnormal
- E16: SSR for each heater is open circuit
- E18: Malfunctions related UV lamp (bulb blown out, a glow lamp missing, etc)

The following are descriptions of each error codes;

E01: CO_2 cylinder becomes empty

If CO_2 level is not increased by 0.1% in a minute when CO_2 valve is open, “E01” and chamber temperature are displayed alternately, audible alarm sounds intermittently.
The diagnosis that CO_2 cylinder becomes empty, is done two times, therefore it takes approximately 2minutes to display an error code after the cylinder becomes empty.

E05,E06: Temp. sensor is open / short circuited

When a temperature in temp. sensor is lower than 0℃, diagnosis is given that temp. sensor is open circuited displaying “E05” alternately with chamber temperature.
Audible alarm sounds intermittently.
When a temperature in temp. sensor is higher than +60℃, diagnosis is given that temp. sensor is short circuited displaying “E06” alternately with chamber temperature.
Audible alarm sounds intermittently.

Note) In E05 and E06, displayed temperature is different from product’s actual temperature.

E09, E10: AT sensor is open / short circuited

When a temperature in AT sensor is lower than 0℃, diagnosis is given that AT sensor is open circuited displaying “E09” alternately with chamber temperature.
Audible alarm sounds intermittently.
When a temperature in AT sensor is higher than +60℃, diagnosis is given that AT sensor is short circuited displaying “E10” alternately with chamber temperature.
Audible alarm sounds intermittently.

Note) In E09 and E10, displayed temperature is different from product’s actual temperature.

E11: CO_2 sensor output voltage is abnormal

When CO_2 sensor box temperature is stable and high or low temperature alarm is not occurred, it is judged as CO_2 sensor malfunction if CO_2 output voltage is lower than 1000mV or higher than 4800mV. “E11” and chamber temperature are displayed alternately, and audible alarm sounds intermittently.
At the time, CO_2 valve is closed.

E12: Main heater is abnormal
When main heater is open circuited or SSR for main heater is short circuited, “E12” and a chamber temperature are displayed alternately and buzzer sounds intermittently. An error code is not always displayed just after failed, because the self-diagnosis for SSR and heater is done in every 40 minutes or when a power is supplied.

E13: Bottom heater is abnormal
When bottom heater is open circuited or SSR for bottom heater is short circuited, “E13” and a chamber temperature are displayed alternately and audible alarm sounds intermittently.
An error code is not always displayed just after failed, because the self-diagnosis for SSR and heater is done in every 40 minutes or when a power is supplied.

E14: Door heater is abnormal
When door heater is open circuited or SSR for door heater is short circuited, “E14” and a chamber temperature are displayed alternately and audible alarm sounds intermittently.
An error code is not always displayed just after failed, because the self-diagnosis for SSR and heater is done in every 40 minutes or when a power is supplied.

E16: SSR is open circuit
When SSR for main heater, bottom heater and door heater is open circuited, “E16” and a chamber temperature are displayed alternately, and audible alarm sounds intermittently.
An error code is not always displayed just after failed, because the self-diagnosis for SSR and heater is done in every 40 minutes or when a power is supplied.

E18: UV lamp malfunction
Note: UV lamp is optional component. It is necessary to select ‘001’ (UV lamp is installed) in F20 beforehand.
If there is malfunction on UV lamp, ‘E18’ and a chamber temperature are displayed alternately. Audible alarm sounds intermittently.
Press BUZZER key to cancel the error.
If a door is opened within 30 seconds while a unit detects a voltage, the unit will not detect UV because counting is cleared.

6. Alarms

Upper limit temperature alarm:

When a chamber temperature is over setting temperature for high temperature alarm, OVERHEAT lamp illuminates displaying chamber temperature and “E12” (main heater malfunction) or “E16” (SSR for each heater is open circuited) alternately. Audible alarm sounds intermittently. Audible alarm does not silence by pressing BUZZER key.
At the time heaters (main heater, bottom heater and door heater) will be OFF.

Automatic temperature alarm

When a chamber temperature deviates from set temperature ± 1.0℃, all digits in temperature display will flash and audible alarm sounds intermittently in 15 minutes later.

Automatic CO_2 level alarm

When CO_2 level deviates from set level ± 1.0%, all digits in CO_2 display will flash and audible alarm sounds intermittently in 15 minutes later.

Door alarm

When a door is open, DOOR lamp will illuminate. At the time, fan motor, CO2 valve will not be active.
When a door leaves open for 60 seconds, fan motor, CO2 valve, heater and UV lamp will not be active.
When a door is closed, DOOR lamp will go off.

7. Key Lock mode

How to set: In chamber temperature display, press ▶▶ key for 5 seconds to step to Key Lock mode.
When a value is set in 'L1' by pressing ▲ key, Key Lock is set.
When a value is set in 'L0' by pressing ▲ key, Key Lock is unset.
Press SET key to memorize the value and automatically returns to chamber temperature display.

Note) In Key Lock mode, the device can step to setting mode, but a setting value cannot be changed. The device also cannot step to Function mode.

8. Automatic UV lamp illumination

Purpose: For the prevention of contamination, UV lamp will illuminate for predetermined time which is set in F01, if a door is closed for 12 hours.
Note: UV lamp is optional component. It is necessary to select '001' (UV lamp is installed) in F20 beforehand.

9. Auto return

Function: If there are no key operations for 90 seconds on the way of setting mode, Key Lock mode and Function mode, a device automatically returns to chamber temperature display without memorizing value to be changed.

10. Calibration

Temperature calibration: In chamber temperature display, press CAL key for 5seconds to step to temperature calibration mode.
Input a proper value by pressing ▲ key and ▶▶ key.
Press ENT key to store the value and a device automatically returns to chamber temperature display.

CO_2 zero calibration: In chamber display, press CAL key for 5seconds to step to temperature calibration mode and press CAL key again to step to CO_2 calibration mode.
Input '000' by pressing ▲ key and ▶▶ key.
Press ENT key to recognize and memorize the value as zero calibration.
A device automatically returns to chamber temperature display.

CO_2 span calibration: In chamber display, press CAL key for 5seconds to step to temperature calibration mode and press CAL key again to step to CO_2 span calibration mode.
Input a proper value by pressing ▲ key and ▶▶ key.
Press ENT key to recognize and memorize the value as span calibration.
A device automatically returns to chamber temperature display.
When CO_2 is less than '0.2%' on the display, input value will be cancelled with an error tone emits and a device automatically returns to chamber temperature display.

11. CO_2 calibration/measuring mode

In CO_2 calibration/measuring mode, CO_2 density should be measured through sample port at inner door.

When a chamber temperature is stabilized (within set temperature -3℃), press CAL key to enable a device to enter CO_2 calibration/measuring mode.

Circulating fan will not stop rotating during this mode if an outer door is opened.

Dot on the CO_2 display will blink.

Automatically finish CO_2 calibration/measuring mode after 5 minutes elapse and buzzer sounds for 3 times.

When a chamber temperature is lower than set temperature-3℃, CO_2 calibration/measuring mode will also come to end.

If CAL key is pressed during CO2 calibration/measuring mode, a device will perform this mode for another 5 minutes from the beginning.

12. Function mode

F01: Setting of UV lamp illuminating time (Factory default: 000)
F02: Setting of UV lamp 24hours sterilization mode
F03: Input of Service code (Service code: 384)
F04: Display of UV lamp accumulation time
F05: Display of CO_2 sensor input voltage
F06: Setting of output ratio on bottom heater (Factory default: 7)
F07: Setting of output ratio on door heater (Factory default: 5)
F08: Setting of Auto changer mode and DEMO mode (Factory default: 000)
F10: Display of adjustment value for CO_2 zero calibration
F11: Display of adjustment value for CO_2 span calibration
F12: Display of temperature on AT sensor
F13: Initialize of non-volatile memory
F14: Performance check of LEDs and drivers
F15: Display of adjustment value for temperature zero calibration (Factory default: 008)
F20: Setting of optional components (UV lamp, water sensor) (Factory default: 000)
F21: Setting of address (ID) for communication device (Factory default: 000)
F22: Setting of communication parameter (Factory default: 000)
F24: Setting of linkage action between remote alarm and buzzer (Factory default: 000)
F25: Setting of Ring Back time (Factory default: 030)
F30: Display of ROM version

How to access to Function mode: In chamber temperature display, press CAL key for 5seconds to step to temperature calibration mode.
Input a Function code by pressing ▶▶ key and ▲ key, and press ENT key.

F01: Setting of UV lamp illuminating time (Factory default: 0 minute, Range:0~30 minutes)
Note) It is necessary to select '001' (installed) in F20 beforehand.

<Operation> Input "F01" on temperature display and press ENT key.
Current setting time appears on CO_2 display.
Input a value by pressing ▲ key and ▶▶ key and press ENT key to store the value.
A device automatically returns to chamber temperature display.
If a value deviates from setting range is input and ENT key is pressed, audible alarm sounds for a second and a previous setting value remains.

<Action> UV lamp illuminates for predetermined setting time and goes off automatically after a door is open and closed. There are 3~5 seconds delay to illuminate UV lamp, because water sensor checks water level preceding just after a door is closed.
UV lamp does not illuminate when a door is open.
UV lamp goes off if door is open during UV lamp illuminates.

F02: Setting of UV lamp 24hours sterilization mode
Note) It is necessary to select '001' (installed) in F20 beforehand.
<Operation> Input "F02" on temperature display and press ENT key.
"000" appears on CO_2 display.
Input "001" with ▲▲ key and ▶▶ key to step to 24hours sterilization mode.
At the time press ENT key displaying with "001" to simply return to chamber temperature display.
<Action> When 24hours sterilization mode is set in F02, UV lamp starts illuminating and automatically goes off after 24hours has passed. In the middle of 24hours sterilization, if the door is opened, UV lamp goes off and 24hours sterilization mode would be cancelled.
If 24hours sterilization mode is reset in the middle in F02, the mode would start operation from the beginning.
Note) UV indicator should illuminate when UV lamp illuminates, so the indicator will illuminate if UV lamp is uninstalled

F03: Input of service code (384)
Note) This function is only available for persons who know service code.
<Operation> Input service code "384" to use the functions except for F01, F02, F21, F22, F24, F25 and F30.
Input "F03" on temperature display then press ENT key to show "000" on CO_2 display. ("384" is appeared if service code has been already input)
Input service code "384" with ▲▲ key and ▶▶ key, and press ENT key to return to chamber temperature display.
Now the functions latter than F03 are ready to use.
If a function code which is latter than F04 is input without inputting service code and ENT key is pressed, a device automatically returns to chamber temperature display and audible alarm sounds for 1 second.
Note) Service code is stored unless "000" is input in F03 or a main power turns off.

F04: Display of UV lamp accumulation time (Range:0~260%)
Note) It is necessary to select '001' (installed) in F20 beforehand.
<Operation> Input "F04" on temperature display and press ENT key to display UV lamp accumulation time on CO_2 display. (Unit:%)
<Description> UV lamp accumulation time is written in non-volatile memory with every 24 hours.
UV lamp setting illuminating time is added to accumulation time by the unit of minute. (When it is less than 5 minutes, 5 minutes is added.)
24 hours (actually 4.4 hours) are added when a device is set in 24 hours sterilization mode (selected "001" in F02).
When UV lamp accumulation time is over 1000 hours, UV indicator on control panel will flash.
Display accumulation time and change to "000" by using ▲▲ key and ▶▶ key.
<Reset> Press ENTER key.

Action of UV indicator on control panel

UV lamp accumulation time	When UV lamp illuminates	When UV lamp goes off
Up to 1000hours	Illuminates	Goes off
1000hours or more	Illuminates	Flashes

F05: Display of CO2 sensor input voltage
<Operation> Input "F05" on temperature display and press ENT key to show the voltage on CO_2 sensor on CO_2 display. Press ENT key to be Auto Zero forcibly performed within a minute. Press ENT key to come to the end, because Auto Return is ineffective in this mode.
CO_2 is not injected during F05 is displayed.

F06: Setting of output ratio on bottom heater (Factory default:7, Range: 0~49)

<Operation> Input “F06” on temperature display and press ENT key to show a current setting value on CO_2 display.
If you want humidity higher than current setting, input bigger numerical value.
If you want humidity lower than current setting, input smaller numerical value.
Press ENT key to store the value and automatically returns to chamber temperature display.

F07: Setting of output ratio on door heater (Factory default: 5, Range: 0~19)
This function is for the prevention of dew condensation on glass door.

<Operation> Input “F07” on temperature display and press ENT key to show a current setting value on CO_2 display.
If there is dew condensation on a door, input bigger numerical value on CO_2 display. Press ENT key to store the value and a device automatically returns to chamber temperature display.

F08: Setting of Auto Changer mode and Demonstration mode (Factory default: 000)

<Description> Auto Changer mode
One of lamp either A or B which is in current used illuminates.
By pressing A/B key, a cylinder which is in current used stops provision, and a unused cylinder starts provision.
If a cylinder becomes empty, its lamp starts flashing and another cylinder starts provision automatically.
Demonstration mode
This function is used in a demonstration.
A device pretends to control temperature and CO_2, but heaters are not powered and CO_2 valve is not opened.

<Operation> Auto Changer mode
Input “F08” on temperature display and press ENT key to show a current setting value in the 3rd digit of CO_2 display.
0 = Normal mode
1 = Auto changer mode
Demonstration mode
Input “F08” on temperature display and press ENT key to show a current setting value in the 2nd digit of CO_2 display.
0 = Normal mode
1 = Demonstration mode

F10: Display of adjustment value for CO_2 zero calibration (Factory default: 000)

<Operation> Input “F10” on temperature display and press ENT key to display an current adjustment value for CO_2 zero calibration on CO_2 display.
If you press ENT key or there are no key operations for 90seconds, a device automatically returns to chamber temperature display.

<Description> When a current adjustment value for CO_2 zero calibration is 1.3% and zero calibration is performed, -1.3% is the adjustment value for zero calibration.
At the time the display in F10 is “-13”.

F11: Display of an adjustment value for CO_2 span calibration (Default setting: 100)

<Operation> Input “F11” on temperature display and press ENT key to display an current adjustment value for CO_2 span calibration on CO_2 display. If you press ENT key or there are no key operations for 90seconds, a device automatically returns to chamber temperature display.

<Description> This is adjustment value for CO_2 level calibration.
When actual CO_2 level is 4.5% and CO_2 display is 5.0%, if “4.5%” is input for CO_2 zero calibration, the adjustment value obtained from calculation is 4.5/5.0 x 100 (Default setting) = 90.

F12: Display of a temperature on AT sensor

<Operation> Input “F12” on temperature display and press ENT key to display a temperature on AT sensor on CO_2 display. If you press ENT key or if there are no key operations for 90seconds, a device automatically returns to chamber temperature display.

Note) Temperature on AT sensor is about 5℃higher than an actual ambient temperature, because AT sensor is placed on a PCB in back cover, where it is affected by waste heat from electric components.

F13: Initialization of non-volatile memory (Factory default: 000)

This function should be used only when data in the non-volatile memory cannot be restored owing to unexpected events (ex: noise).

<Operation> Input “F13” on temperature display and press ENT key to display “000” on CO_2 display. Change the 1st digit to “1” and press ENT key to initialize all the data in non-volatile memory.

Default settings in non-volatile memory:

Chamber temperature	: 37.0℃
CO_2 level	: 0.0%
UV lamp lighting time (F01)	: 0 minute
UV lamp accumulation rate (F04)	: 0%
Balance value of humidifying heater (F06)	: 7
Balance value of door heater (F07)	: 5
Data for CO_2 zero calibration (F10)	: 000
Data for CO_2 span calibration (F11)	: 100
Data for temperature zero calibration (F15)	: 008
Optional setting of UV lamp/water sensor (F20)	: Uninstalled (0)
Communication ID (F21)	: 0
Communication mode (F22)	: 0
Linkage action between remote alarm and buzzer (F24)	: Not linked (0)
Ring back	: 30 minutes
Key Lock data	: OFF
Auto Changer data (the 3rd digit in F08)	: OFF
Demo Mode data (the 2nd digit in F08)	: OFF

Input “F13” on temperature display and press ENT key to display “000” on CO_2 display. Change the 1st digit to “2” and press ENT key to initialize following data in non-volatile memory.

Data for CO_2 zero calibration (F10)	: 000
Data for CO_2 span calibration (F11)	: 100

Note) Service code should not be initialized.

F14: Check of LEDs and drivers performance

<Operation> Input “F14” on temperature display and press ENT key to flash lamps and the all digits, and buzzer sounds with 0.5seconds intervals.
Press ENT key to stop action.
If there are no key operations for 90seconds, a device automatically returns to chamber temperature display.

F15: Display of adjustment value for temperature zero calibration
(Factory default: 0.8℃)

<Operation> Input “F15” on temperature display and press ENT key to display an adjustment value for temperature zero calibration on CO_2 display. If you press ENT key or if there are no key operations for 90seconds, a device automatically returns to chamber temperature display.

(Ex.) When “37.0” is displayed and actual temperature is “37.8”, if you input “37.8” as temperature calibration, “+0.8” will be stored in F15. Press ENT key to display the value on CO_2 display.

F20: Optional setting of UV lamp/water sensor (Factory default: 000)

<Operation> Input “F20” on temperature display and press ENT key to display “000” on CO_2 display. If there are no key operations for 90 seconds, a device automatically returns to chamber temperature display.
000: Uninstalled
001: Installed

F21: Setting of serial communication ID (Factory default: 000 Range:000~255)

<Operation> Input “F21” on temperature display and press ENT key to display “000” on CO_2 display. Input a value (serial communication ID numbers) which identifies a product and press ENT key to store serial communication ID.
000: Not communicated

Collection data sending from apparatus to PC:

- Chamber temperature
- CO_2 level
- UV lamp illuminating time
- AT sensor temperature
- Door open time
- Water level in humidifying pan
- UV lamp accumulation time

Setting data sending from PC to apparatus:

- Chamber temperature
- CO_2 level
- UV lamp illumination time

F22: Setting of serial communication mode (Factory default: 000)

<Operation> Input “F22” on temperature display and press ENT key to display “000” on CO_2 display. Change the 3rd digit to set the communication mode.

Control mode (the 3rd digit)	0: Local (Default)
	1: Remote
Baud rate (the 2nd digit)	0: 2400bps (Default)
	1: 4800bps
	2: 9600bps

F24: Linkage action between remote alarm and buzzer (Factory default: 000)

<Direction for use> Input “F24” on temperature display and press ENT key to show “00X” on CO_2 display. Change the 1st digit to change linkage action.
000: Not linked between remote alarm and buzzer
001: Linked between remote alarm and buzzer

F25: Setting of Ring back time (Factory default: 030 (30min), Range: 0~60min)

<Operation> Input “F25” on temperature display and press ENT key to set current Ring Back delay time. Change the 2nd digit to set delay time.
000: Not Ring back

F30: Display of ROM version

<Operation> Input “F30” on temperature display and press ENT key to display current ROM version on CO_2 display.

13. Bottom heater control

Purpose: Bottom heater is controlled at predetermined time in F06 to shorten humidity recovery time.

When a chamber temperature is within set temperature -0.4℃~-0.8℃, bottom heater is turned on for 1 minute at longest, except for a while a chamber temperature stabilizes after a power was turned on or an outer door leaves open for 70 seconds or more.

14. Door heater control

Basically door heater is turned on by same rate as main heater, and it is turned on by the rate which is predetermined by F07.

15. Remote alarm contact

Normal condition: “Close” between COM and N.C. “Open” between COM and N.O.
Alarming condition: “Open” between COM and N.C. “Close” between COM and N.O.

Ring back time and linkage action between remote alarm and buzzer will be changed depend on the setting in F24 and F25.

16. Prevention for temperature/CO_2 overshooting

It is removed numerical value “+0.2~+0.3” from setting value on temperature or CO_2 display during pull-up.
It is not removed a value from setting value on temperature or CO_2 display when a device returns from overshooting with setting value “+0.4” or more.

17. CO_2 display stabilization

Buffer rate which is just before CO2 level is displayed is more than setting value -0.05% and less than setting value, setting value will be displayed.
Ex.) 4.95% < Buffer rate < 5.00% => 5.00% will be displayed.

18. Ring back

Purpose: To prevent someone from pressing BUZZER key to stop alarm buzzer and remote alarm activating when a device is in alarming condition.
Operation: 1) Alarm buzzer and remote alarm are active again after predetermined setting time elapses, if someone presses BUZZER key.

Correlation between alarming condition and Ring back

Unit status	Ring back time: 30 minutes (F25 = 030)	Not Ring back (F25 = 000)
Alarming condition	Press BUZZER key to stop audible alarm sounding. Remote alarm action remains on control panel.	
Recovery from alarming condition	Stand-by for alarm	
Alarming condition remains after setting time elapse	Audible alarm sounds again after 30 minutes elapse when BUZZER key is pressed.	Audible alarm does not sound again when BUZZER key is pressed, if a unit remains alarming condition. Remote alarm and alarming display is active.

Ring back time

Setting value	Ring back time after audible alarm is cancelled by pressing BUZZER key
000	Not Ring back
010	10 minutes
020	20 minutes
030	30 minutes
040	40 minutes
050	50 minutes
060	60 minutes

Linkage between buzzer and remote alarm (For service use only)

		Remote alarm action	
		Not linked with buzzer (F24 = 000)	Linked with buzzer (F24 = 001)
Ring back setting	F25: 030 (30min) (Factory default)	● Buzzer sounds again ● Remote alarm remains active	● Buzzer sounds again ● Remote alarm is active again
	F25: 000 (Not ring back)	● Buzzer does not sound again ● Remote alarm remains active	● Buzzer does not sound again ● Remote alarm is not active again

19. Temperature offset

Purpose: Add 0.8℃ to calibrate a gap between temperature on temperature sensor and 1/2H temperature.

20. Water sensor action

Note) Water sensor is optional components. It is necessary to select '001' (installed) in F20 beforehand.

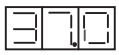
Action: It diagnoses that there is water in humidifying pan when water sensor can detect water level for three times in 1 second interval.
If water sensor cannot detect water level for five times, it diagnoses that there is not water in humidifying pan.
RH PAN lamp flashes when water sensor detects low water level in humidifying pan.

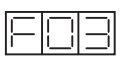
Timing: 1) When a main power is turned on
2) When an outer door is closed
3) Every 30 minutes until an outer door is opened

Note) When an outer door is opened or UV lamp illuminates, water sensor will be inoperative.

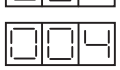
21. Example for LED displays

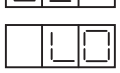
Current temperature +36.2℃

Set temperature +37.0℃ 

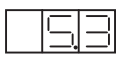
Function F03 

(Service code input)

Bottom heater ratio 004 

Lock Mode L 0 

CO_2 level +5.0%

Value for CO_2 zero calibration 5.3% 

UV lamp accumulation time 135%

CO_2 gas error E01

Specifications of sensor

■ Temperature/Resistance for temperature sensor 103AT-1

Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)
0	27.28	17	13.57	34	7.19
1	26.13	18	13.06	35	6.94
2	25.03	19	12.56	36	6.70
3	23.99	20	12.09	37	6.47
4	22.99	21	11.63	38	6.25
5	22.05	22	11.20	39	6.03
6	21.15	23	10.78	40	5.83
7	20.29	24	10.38	41	5.63
8	19.48	25	10.00	42	5.44
9	18.70	26	9.63	43	5.26
10	17.96	27	9.28	44	5.08
11	17.24	28	8.94	45	4.91
12	16.55	29	8.62	46	4.75
13	15.90	30	8.31	47	4.59
14	15.28	31	8.02	48	4.44
15	14.68	32	7.73	49	4.30
16	14.12	33	7.46	50	4.16

Prevention of contamination

In servicing for CO_2 incubator, it is important to prevent from contamination.

（1）More than 90% of contamination in CO_2 incubator is caused by mold. Mold is a kind of true fungi, it has high increasing power under high temperature and high humidity. Accordingly, it is easy for mold to increase inside CO_2 incubator. Those increased mold eat up culture (mainly animal cell), eventually precious test sample will be killed. Cell that is independent from ecosystem is also independent from immune system, it has no immunity against all.

（2）Precautions for mold increasing

There are many cases that mold multiply by eating fat on the fingers as a source of nutrient in CO_2 incubator.

Therefore,

①Be sure to wash and sterilize your hands prior to servicing. Use 70% ethanol.

②In installing, sterilize the inside wall and shelves after removing shelves, duct, humidifying pan and so on with 70% ethanol.

（3）In the case that mold has already multiplied.

Sterilize the interior (walls) and shelves with 70% ethanol after removed all items from the chamber as same as (2)-② above.

And you should sterilize again after 24 hours once sterilized, when the root of spore is geminated, because it is too difficult to remove spore of mold. Repeat sterilization is effective.

NOTICE

In general, stainless steel is known that it is not easy（hard）to rust.

However depends on the conditions, rust might generate.

When you remove rust, we recommend the following agents.

Besides, the surface may become foggy.

Recommended agent:

1. Cream cleanser「Gif」（Nippon Leva）
2. Picasso #SUS300-W（Chemical YAMAMOTO）

＜Picasso has greater capability of clean for rust than Gif.＞

Operation check after replacing CO_2 sensor and main P.C.B

Note:
Ensure that setting values for F01, F06, F07, F08, F21 and F25 should be written down before replacing main PCB.

1. Call F03 and input “384” (service code).
   (1) Press CAL key for 5 seconds and call “F03” by using ⏫ key and ⏩ key. Press ENT key.
   (2) Input “384” and press ENT key.

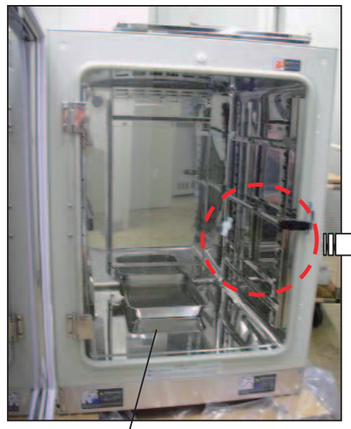
2. Fill distilled water in humidifying pan and set a chamber temperature at 37℃.
   (1) Run a unit for approx. 8hours* and ensure chamber humidity should be equal or higher than 90%.
   * Note) Required humidity will be usually obtained after a unit keeps running for approx. 5 hours without door opening.
   (2) CO_2 density should be set at 0%.
   (3) Ensure there should be no condensation in the chamber. If there is, step to F06 and decrease output ratio for bottom heater. If there is condensation on an inner door, step to F07 and increase output ratio for door heater.
   (4) Measure chamber temperature by using standard thermometer (unit: 0.1℃) or PT100Ω sensor.

3. Temperature and CO2 calibration
   Temperature and CO2 calibration should be done in accordance with calibration procedures.
   See Page 6 for Temperature calibration, Page 7 for CO2 calibration.

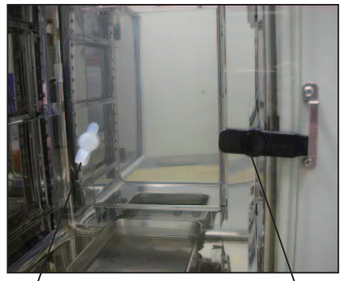
Parts layout

Control panel on outer door

Outer door is open



Humidifying pan



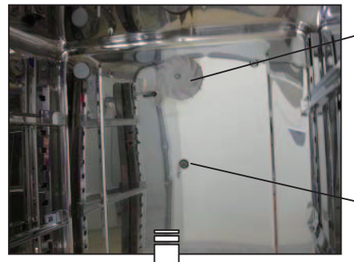
Sampling port

Inner door latch

In the chamber

Humidifying pan

Inner wall

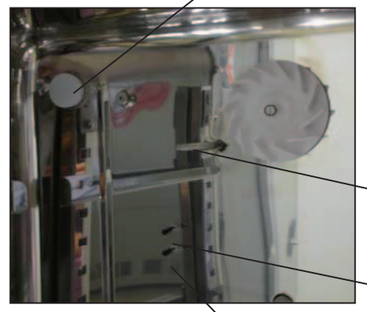


Circulating fan

CO2 sensor

Inner wall

Access hole with cap



CO2 injection pipe

Overheat protect sensor

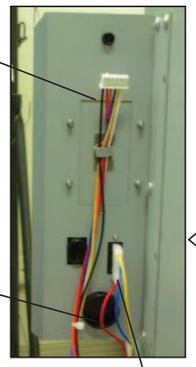
Temp. sensor

CO2 sensor

PCB for CO2 sensor
(Cover is removed)

* Lead wires for
MTR-480/L03

* Place to fit
glow starter
（for MCO-18UVS3）

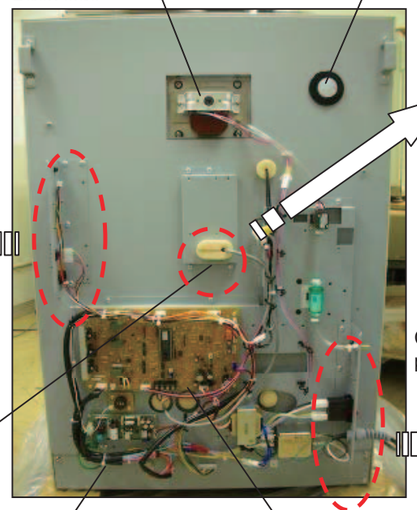


Remote alarm terminal

Back side

Circulating fan motor

Access hole



CO2 sensor

Switching power supply

Main PCB

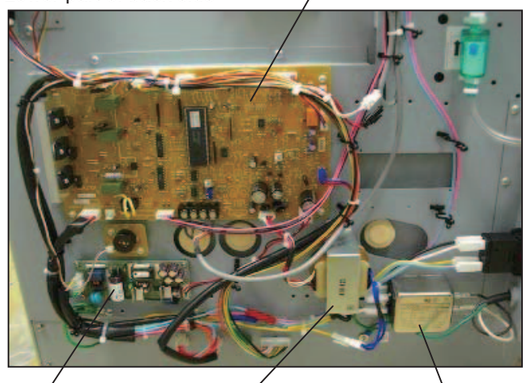
CO2 injection
port A

* CO2 injection
port B（For MCO-21GC）

Power switch

Lower part of back side

Main PCB



Switching power supply

Power transformer

Noise filter

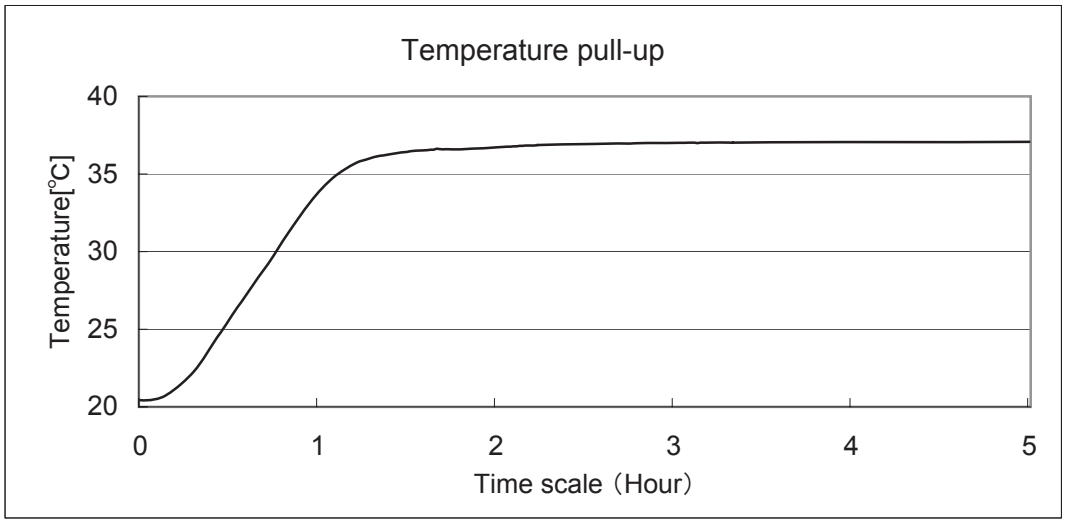
* ･･･For optional components

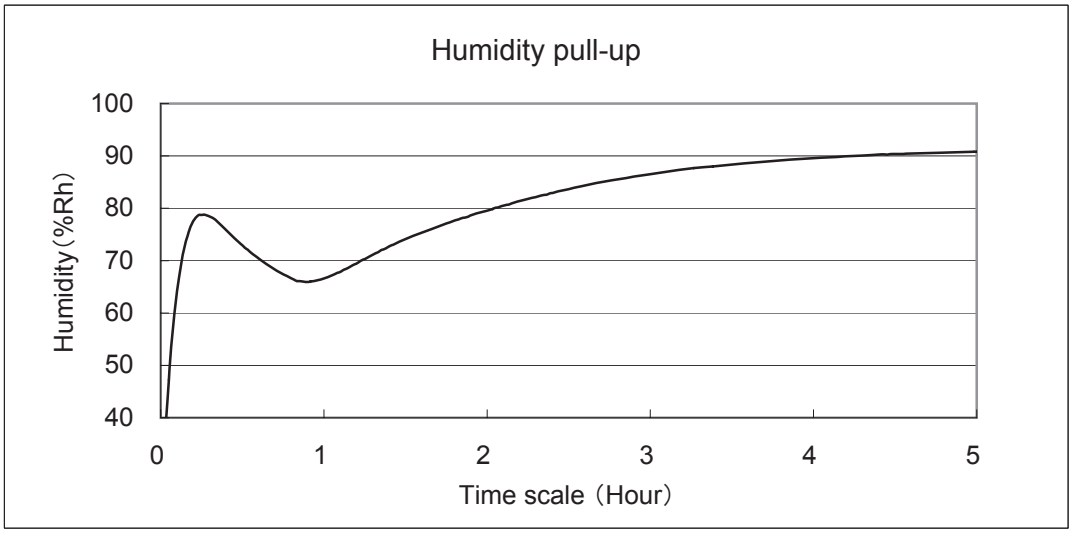
Test data

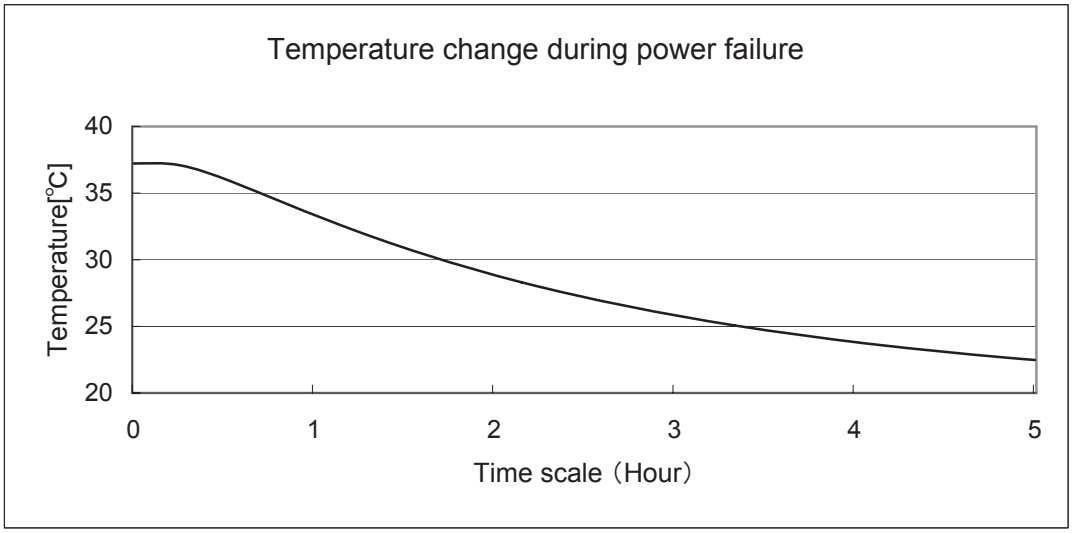
Note) These data are the reference only.

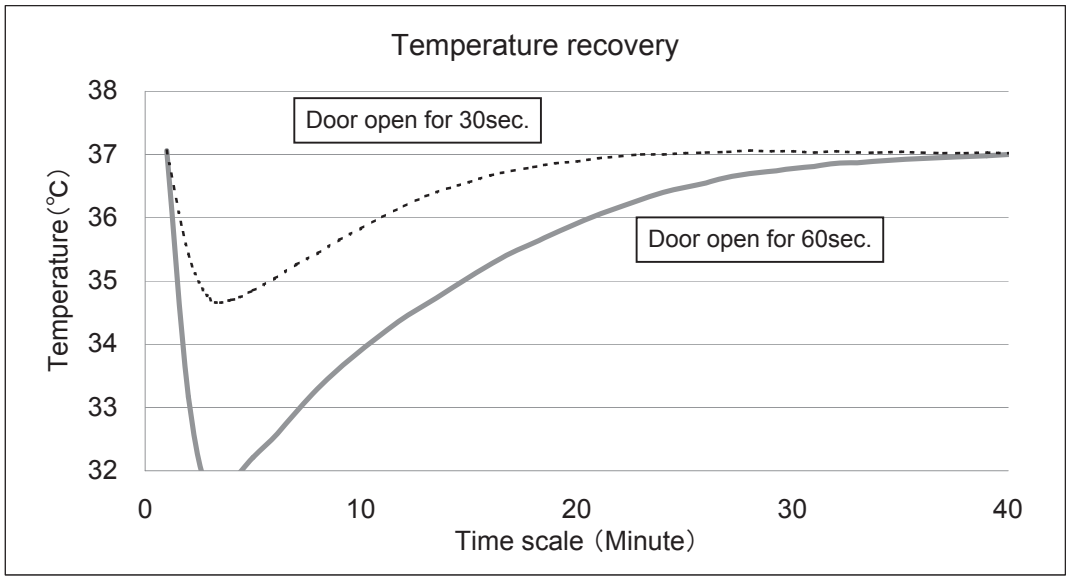
<Measuring condition>

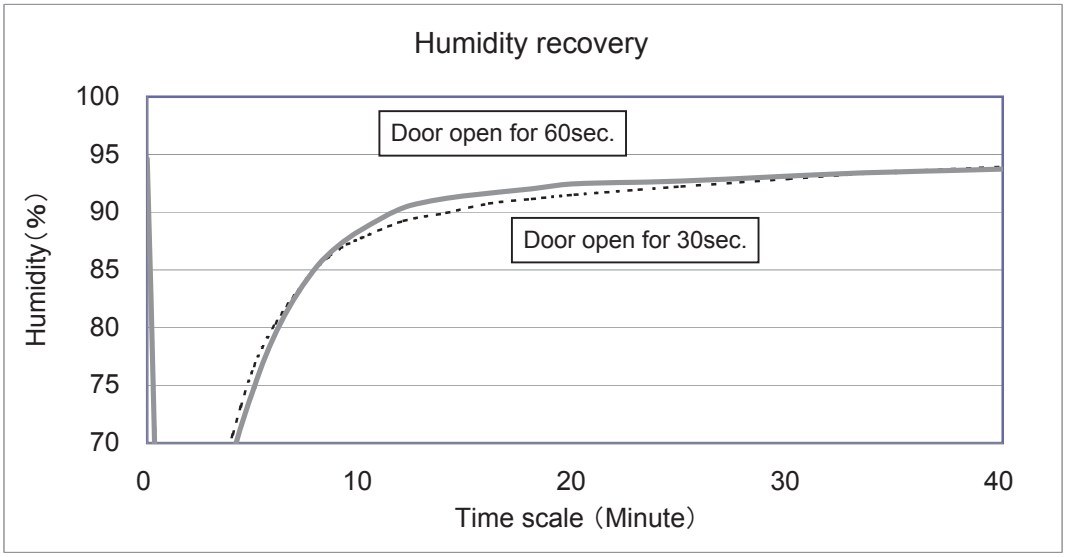
* Ambient temperature: 20℃
* Setting temperature: 37.0℃
* Setting CO2 density: 5.0%
* No load

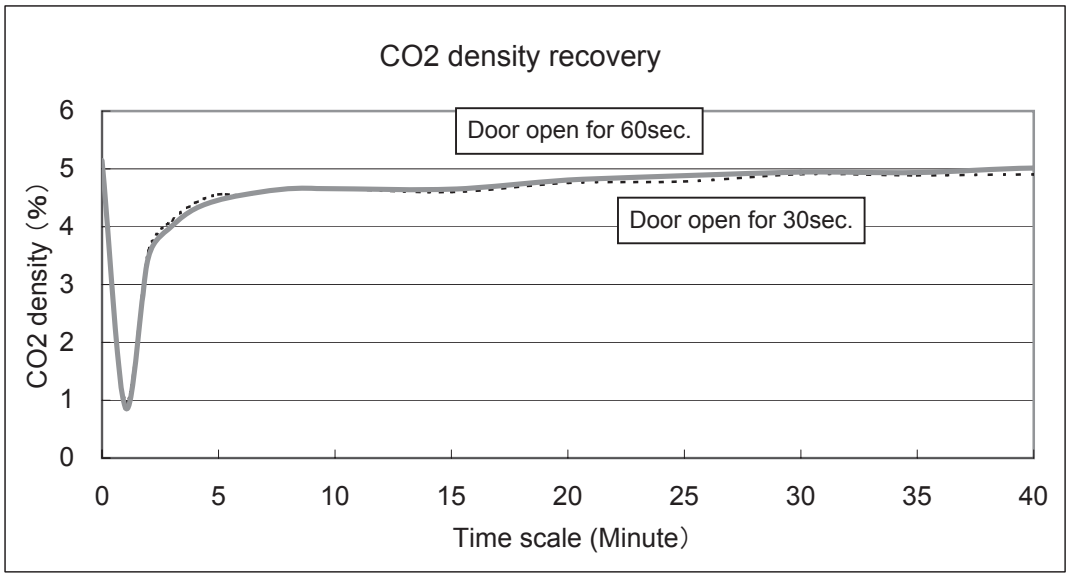


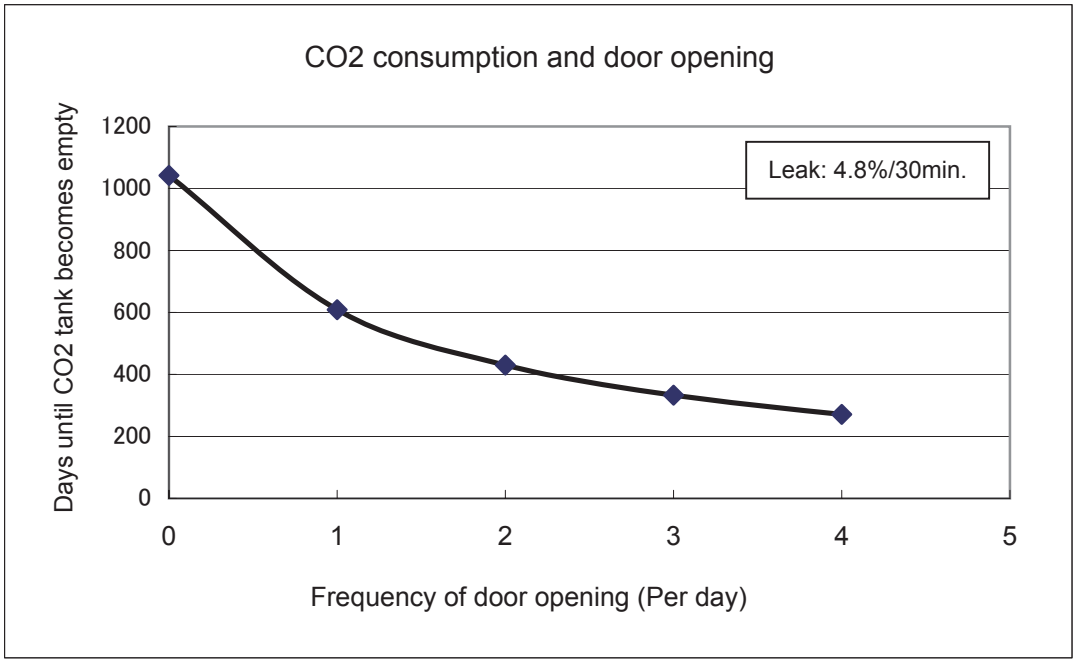



Temperature change during power failure
Temperature[℃]
40
35
30
25
20
0
1
2
3
4
5
Time scale（Hour）


Temperature recovery
Temperature（℃）
38
37
36
35
34
33
32
Door open for 30sec.
Door open for 60sec.
0
10
20
30
40
Time scale（Minute）


Humidity recovery
Humidity（%）
100
95
90
85
80
75
70
Door open for 60sec.
Door open for 30sec.
0
10
20
30
40
Time scale（Minute）


CO2 density recovery
Door open for 60sec.
Door open for 30sec.
CO2 density（%）
Time scale (Minute）
0
1
2
3
4
5
6
0
5
10
15
20
25
30
35
40


CO2 consumption and door opening
Leak: 4.8%/30min.
Days until CO2 tank becomes empty
Frequency of door opening (Per day)
0
200
400
600
800
1000
1200
0
1
2
3
4
5

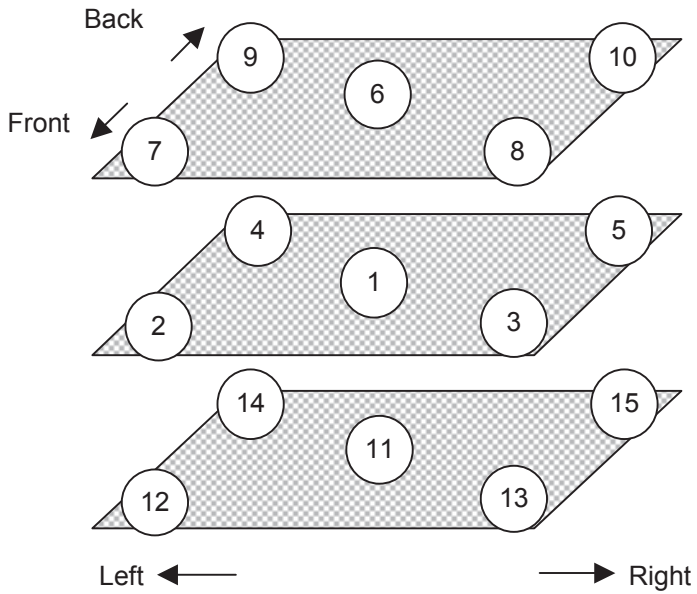
<Temperature uniformity - 15points measured>

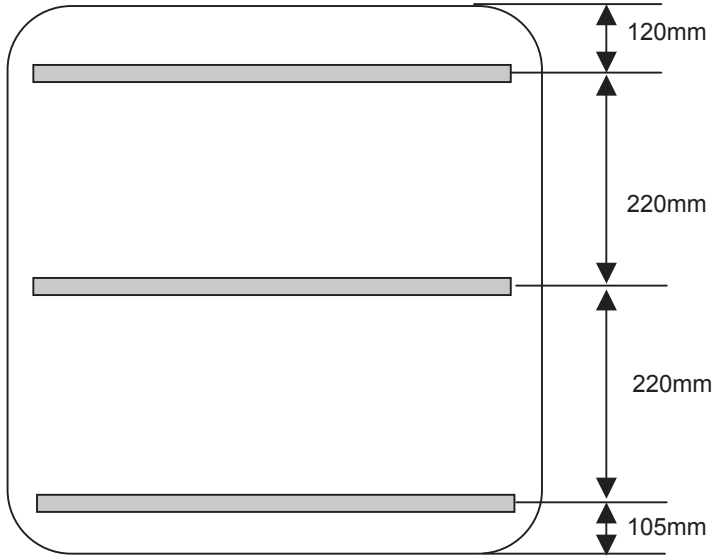
Note) Following data are the reference only.

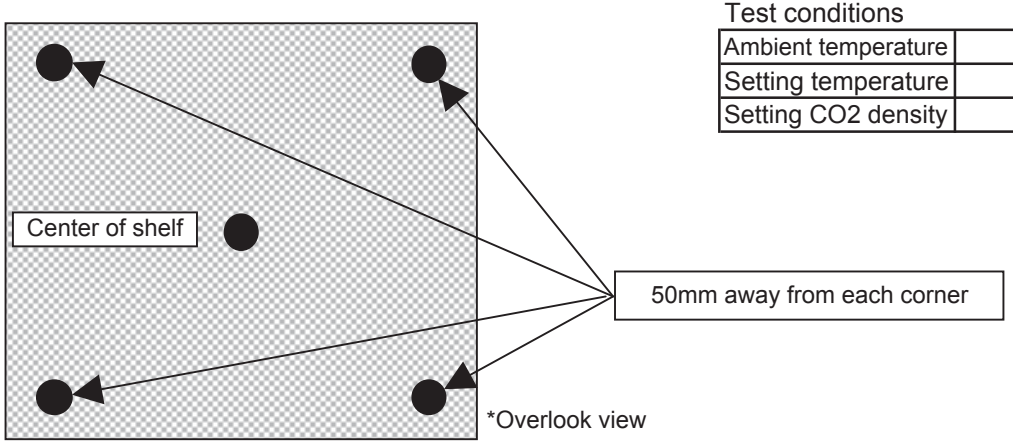
Temperature at each measured points

	Point	Temperature
Middle	1	36.92
	2	37.05
	3	36.94
	4	36.91
	5	36.85
Upper	6	37.04
	7	36.99
	8	37.09
	9	37.00
	10	36.94
Lower	11	36.82
	12	36.96
	13	36.81
	14	36.90
	15	36.81

<Measured points>





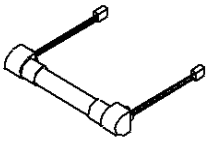


Test conditions

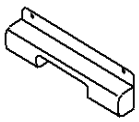
Ambient temperature	25℃
Setting temperature	37℃
Setting CO2 density	0%

UV system kit (MCO-18UVS3)

Kit of MCO-18UVS3

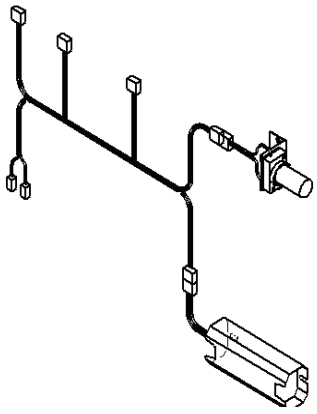


① 1 UV lamp



② 1 UV lamp cover

③ 4 screws（M4）



④ 1 ballast & glow assy

⑤ 1 UV label

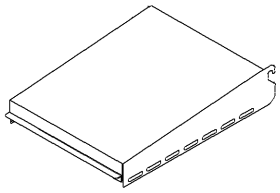
⑥ 1 UV caution label

⑦ 1 UV door switch caution label

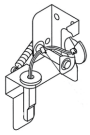
⑧ 1 Name plate

⑨ 1 Patent label

⑩ 1 Model number label



⑪ 1 humidifying pan cover



⑫ 1 water level sensor assy

Procedure

1. Unplug the unit and make sure that power is not supplied to the unit.

2. Remove the duct from inside the unit, then take off 2 caps and 2 screws shown in Fig. 1.

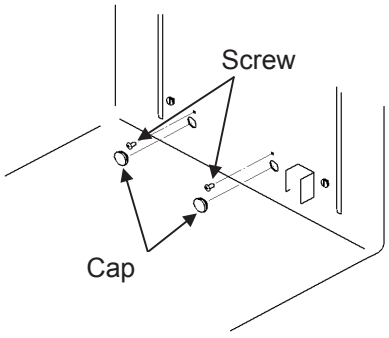


Fig.1

3. Take off the rear cover shown in Fig.2.

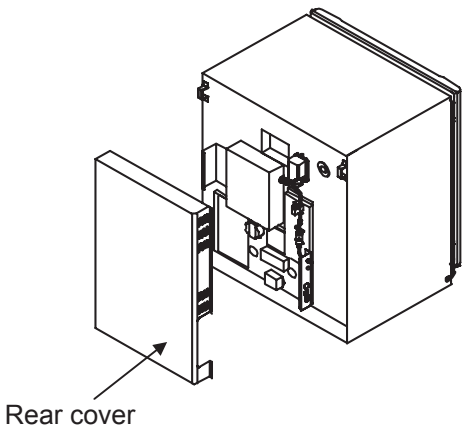


Fig.2

4. Take out two insulations for the UV lamp lead wire hole shown in Fig. 3.
The insulation can be taken out easily by pushing it from inside of the chamber. Keep the insulation for the future use again.

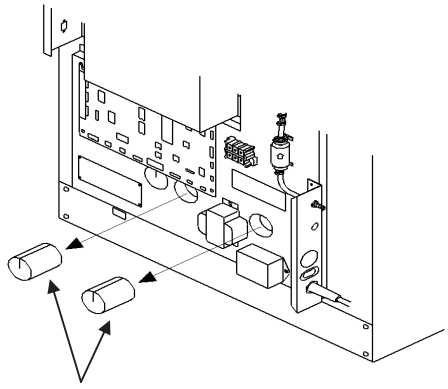


Fig.3

5. Set the UV lamp to the hole and make sure to be fitted properly.
Fix the UV lamp cover with 2 screws.

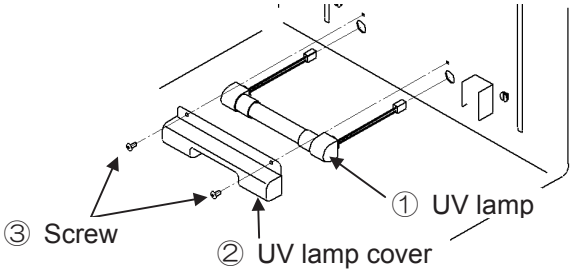


Fig.4

6. Fix the packing and water level sensor assy with 2 screws. See Fig. 5

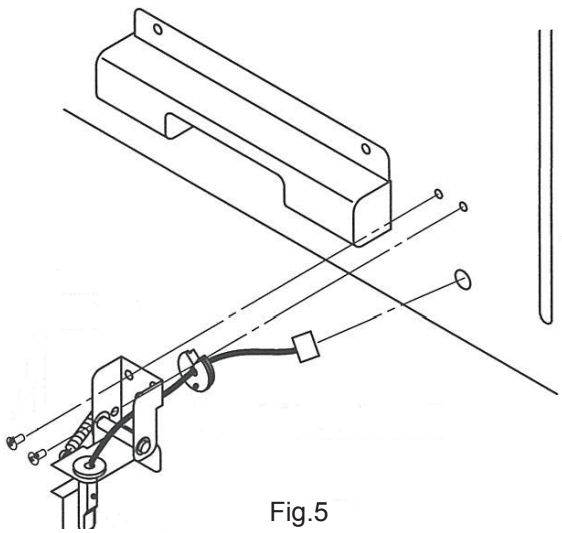


Fig.5

. Replace the duct. Place the humidifying pan, then cover the pan with the humidifying pan cover as shown in Fig. 6

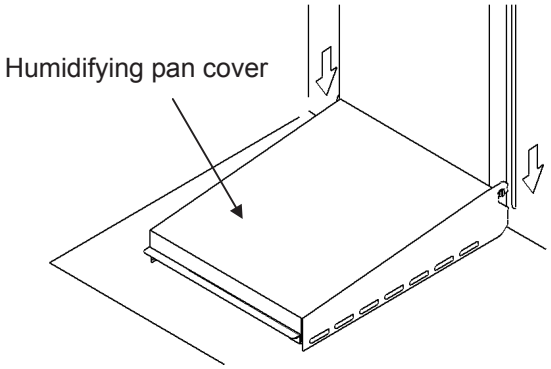


Fig.6

8. Replace the insulation into the UV lamp lead wire hole with the wire passed through the cut on the insulation. See Fig.7

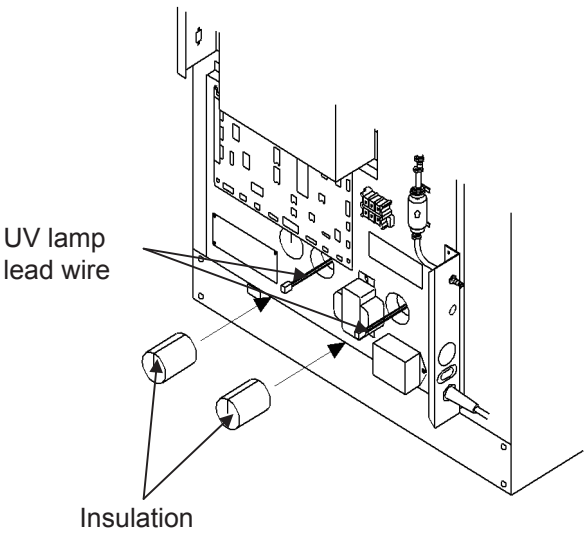


Fig.7

9. Remove a cap shown in Fig. 8.
   By using 4 screws enclosed with this kit,
   fix the ballast/glow assy as shown in Fig. 8.

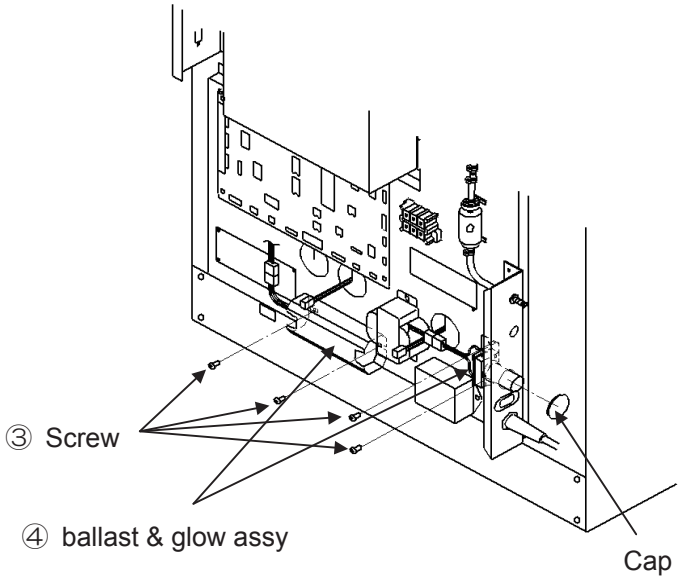


Fig.8

10. Connect each lead wire connector of ballast/glow assy, as shown in Fig. 9.

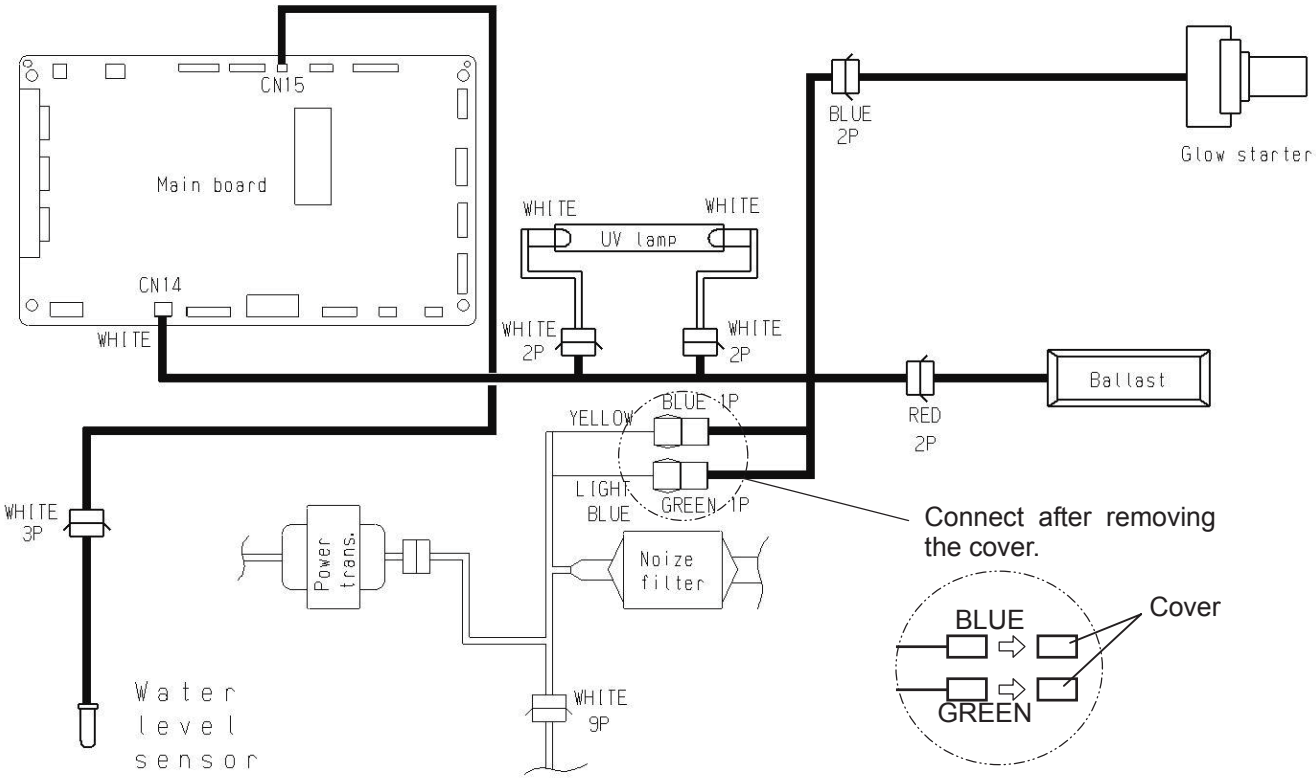


Fig.9

11. Attach the labels.

＊ For ⑧Name plate, use MCO-18AC(UV) label on MCO-18AC.

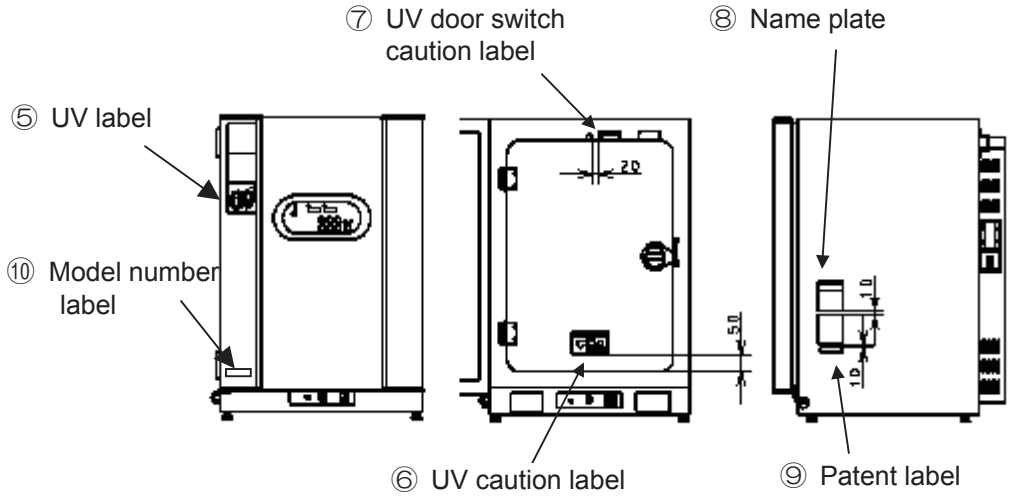


Fig.10

12. Set the UV lamp ON period through control panel

When using UV lamp option, it is needed to set the UV lamp ON period. Refer to the following procedure.

	Description of operation	Key operated	Indication after operation
1	Turn the power switch ON.	-	The current chamber temperature is displayed.
2	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator is flashed.
3	By pressing ▶▶key and ▲▲ key, set the figure to F01.	▶▶ ▲▲	F 0 1
4	Press ENT key.	ENT	In CO_2 density indicator, "000" is displayed and the right digit is flashed. F 0 1 0 0 0
5	By pressing ▶▶key and ▲▲ key, set the figure to 005 (5 minutes of ON period).	▶▶ ▲▲	F 0 1 0 0 5
6	Press ENT key.	ENT	The setting of UV lamp ON time is memorized and the current chamber temperature is displayed.

<<NOTE>>

- The UV lamp ON time is settable between 0 to 30 minutes. However, it is recommended to set 5 minutes in general.
- The UV lamp ON time is settable between 0 to 30 minutes (000 to 030). The UV lamp is not turned ON if the setting is 000.
- The UV lamp is turned off when the outer door is opened while the lamp is on. The lamp is turned on for pre-set duration after the outer door is closed.
- The condensation in the chamber can be caused and/or the chamber temperature distribution can be affected due to the heat from UV lamp when the setting of UV lamp ON time is longer than 5 minutes or the only the outer door is opened/closed repeatedly. In such case, the life of UV lamp is shortened.
- In the procedure 2 above, pressing CAL key for 5 seconds causes the calibration mode. In this mode, it is possible to calibrate the temperature and CO_2 density, and miss operation of the key may affect the basic performance of the unit. Take care of the key operation. Even if the key is operated wrongly, the unit returns to the current value display mode automatically when no key is operated for 90 seconds. In this case, the setting not entered by pressing ENT key is not effective.

13. Check that the UV lamp is turned on.

Check the UV lamp is turned on by the following procedure:

	Procedure
1	Open the outer door and push the door switch with the inner door is closed.
2	Check that the UV indicator on the control panel is on after a few seconds.
3	Check the visible blue light from the front side of the humidifying pan cover. (Check the light with the inner door closed. Never look at the UV light directly.)

14. Set the connection of water level sensor option.

The setting of water level sensor connection is needed when using the water level sensor option. Refer to the following procedure.

	Description of operation	Key operated	Indication after operation
1	Turn the power switch ON.	-	The current chamber temperature is displayed.
2	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator is flashed.
3	By pressing ▶▶ key and ▲ key, set the figure to F20	▶▶ ▲	F 20
4	Press ENT key.	ENT	In CO_2 density indicator, "000" is displayed and the right digit is flashed. F 20 0 0 0
5	By pressing ▶▶ key and ▲ key, set the figure to 001 (optional connection).	▶▶ ▲	F 20 0 0 1
6	Press ENT key.	ENT	The setting of water level sensor connection is memorized and the current chamber temperature is displayed.

《NOTE》

＊The water level sensor will not activate even if the water level sensor option is connected when the F20 is set to 000.

＊In the procedure 2 above, pressing CAL key for 5 seconds causes the calibration mode. In this mode, it is possible to calibrate the temperature and CO_2 density, and miss operation of the key may affect the basic performance of the unit. Take care of the key operation. Even if the key is operated wrongly, the unit returns to the current value display mode automatically when no key is operated for 90 seconds. In this case, the setting not entered by pressing ENT key is not effective.

16. Check that the water level sensor operates.

Check the operation of water level sensor by the following procedure.

	Procedure
1	Open and close the outer door with the humidifying pan empty.
2	Check that RH PAN indicator on the control panel blinks after a few seconds.
3	Open and close the outer door with the humidifying pan full.
4	Check that RH PAN indicator on the control panel is off after a few seconds.

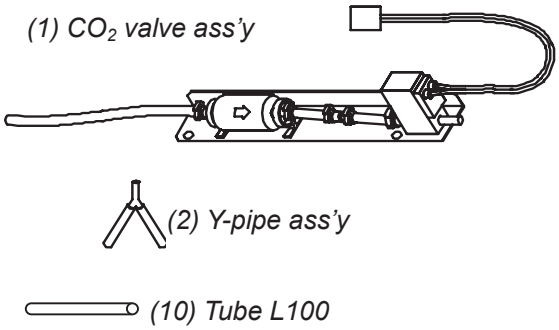
《NOTE》

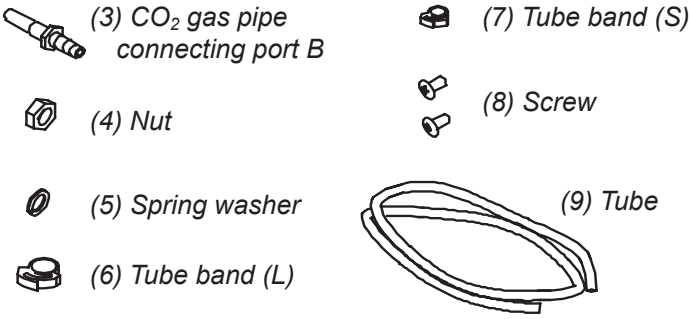
＊Set the humidifying pan cover properly when checking operation of the water level sensor. Also, close the inner door completely.

(The UV lamp is on after operation of the water level sensor when the UV lamp ON period is set. Never loock at the UV light directly.)

Automatic CO_2 cylinder changeover system（MCO-21GC）

<Parts>





<Preparation>

1. Remove the tube band on the *(1) CO_2 valve ass'y*, and remove the hose and the capillary.

2. Fit *(10) tube L100* by the tube band which was removed in procedure 1.
   Make sure the tube band is fixed firmly to prevent gas leakage.

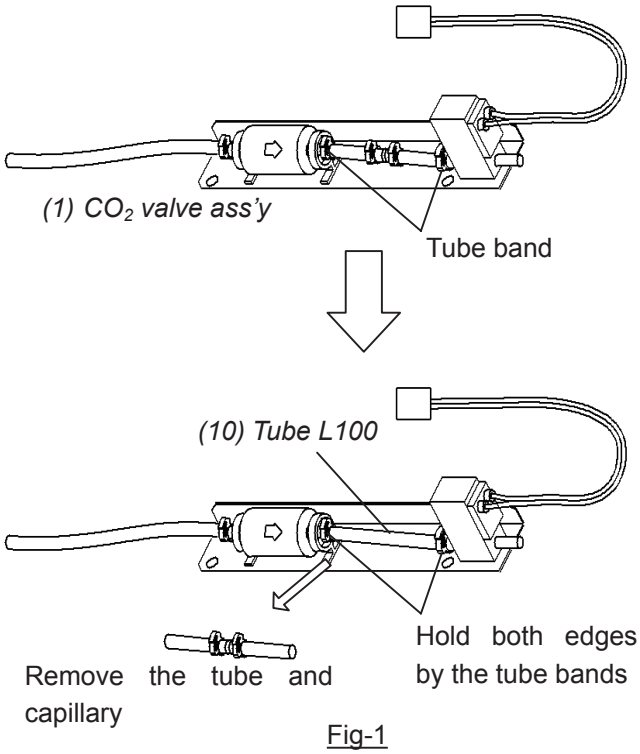


Fig-1

<Installation>

1. Disconnect the power cable and make sure that the unit is not supplied with the power.

2. Loosen and remove 6screws and remove the rear cover.

3. Fit *(1) CO2 valve ass'y* by *(8) 2 screws*. (See Fig-2).

4. Remove the cap and fit *(3) CO2 gas pipe connecting port* B with *(4) Nut* and *(5) Spring washer*.

5. Connect the lead wire of CO_2 valve B with the yellow connector in the harness CN9.

6. Remove the upper tube of CO_2 valve A.
   By using *(2) Y-pipe ass'y,* connect CO_2 valve A and CO_2 valve B and tube X. (See Fig-3)

7. Connect the bottom tube of *(1) CO2 valve ass'y* with *(3) CO2 gas pipe connecting port B*.

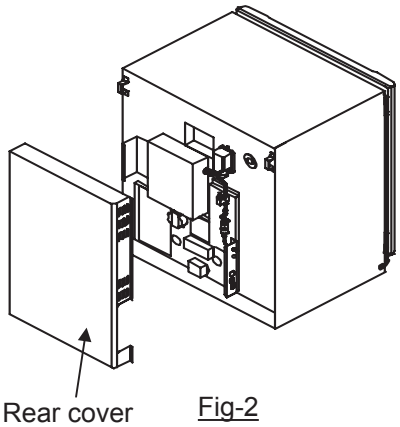


Fig-2

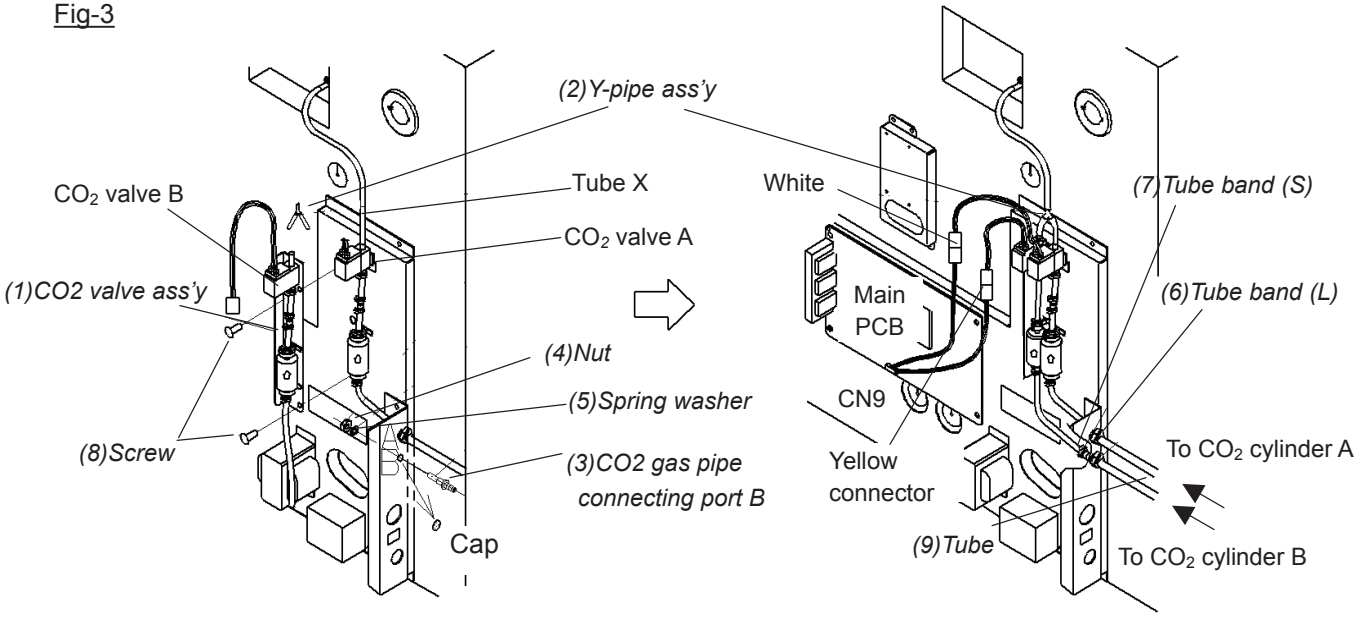
8. By using *(9) Tube*, connect *(3) CO2 gas pipe connecting port B* with CO2 tank B.

9. Fix tubes firmly by using *(6) Tube band (L)* and *(7) Tube band (S)*, such as Fig-3 specified.

10. Install the rear cover back to the position.

NOTE: Every tubes should be connected tight to prevent gas leakage.

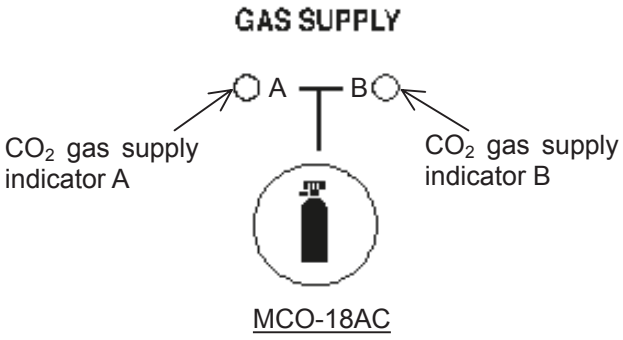
Fig-3



<Setting of CO_2 cylinder automatic changeover mode>

Before using MCO-21GC, it is necessary to set gas auto-changer mode in Function mode.

	Operation	Key	Indication
1	Turn the power switch ON.	---	Current chamber temperature is displayed.
2	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator blinks.
3	Input "F03" by pressing ▶▶ key and ▲▲ key.	▶▶ ▲▲	F 0 3
4	Press ENT key.	ENT	"000" is displayed on CO_2 display. F 0 3 | 0 0 0
5	Input service code "384" by pressing ▶▶ key and ▲▲ key.	▶▶ ▲▲	F 0 3 | 3 8 4
6	Press ENT key.	ENT	Current chamber temperature is displayed.
7	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator blinks.
8	Input "F08" by pressing ▶▶ key and ▲▲ key.	▶▶ ▲▲	F 0 8
9	Press ENT key.	ENT	"0 * *" is displayed on CO_2 display and the right digit flashes. F 0 8 | 0 * *
10	Input "1" in the left digit by pressing ▶▶ key and ▲▲ key. NOTE: You must not change the center and the right digits.	▶▶ ▲▲	F 0 8 | 1 * * "0" or "1" will be displayed on marked *.
11	Press ENT key.	ENT	Current chamber temperature is displayed and gas supply indicator A is lit.



MCO-18AC

<Operation check>

Ensure operation check should be done according to the following procedures after CO2 cylinder automatic changeover mode is setting.

	Procedures
1	Stop injecting CO_2 from the cylinder A and inject it from the cylinder B only.
2	Turn the power switch on. Set 37℃ for the temperature and 0.0% for CO_2 density. Ensure the cylinder A should be selected and the indicator A should be illuminated.
3	Leave the unit for approx. 1 hour until CO_2 density is stabilized.
4	Set 5% for CO_2 density and ensure the CO_2 inject lamp illuminates.
5	Ensure E01 (CO_2 gas cylinder empty alarm) is emit and buzzer sounds after 2-7minutes elapse after CO_2 inject lamp illuminates. Ensure CO_2 is injecting from the cylinder A to the cylinder B. Ensure CO_2 inject lamp A starts blinking and the lamp B is illuminating.
6	Ensure CO_2 density should be reached to 5% and the unit should control CO_2 properly. Note) The unit will break CO_2 controlling during auto-calibration in CO_2 sensor. The decimal point of CO_2 display will blink during auto-calibration in CO2 sensor.
7	Stop injecting CO_2 from the cylinder A and B. Eliminate the message "E01" by pressing BUZZER key. Ensure cylinder to be injected should be selected to the cylinder A. Select the cylinder A by pressing CO_2 gas supply line switching key.

Refer to the Instruction Manual for the detail descriptions about usage of MCO-21GC.

How to reverse door

1. Removal of rear cover

Disconnect the power cable from the outlet and remove rear cover from the unit.

2. Removal of inner/outer door

(1) Loosen and remove 5screws and remove frame panel lower from the unit.

(2) Loosen and remove 4screws, then remove inner door hinge.

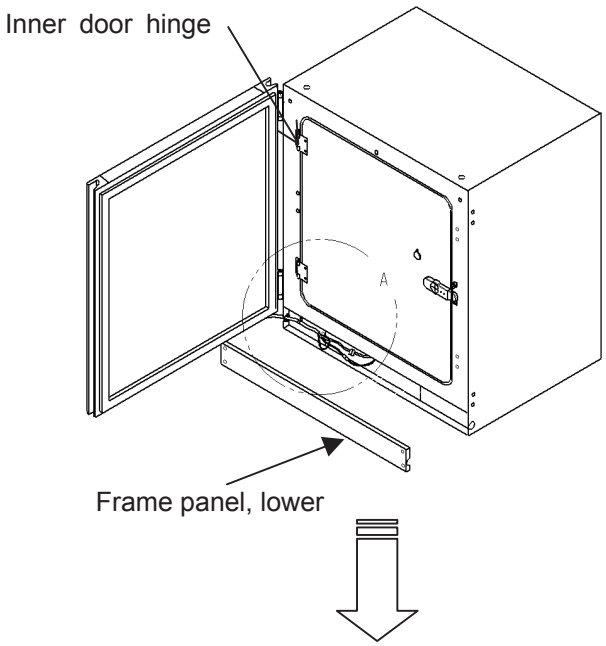
(3) Remove 2 lead wire connectors, ground wire, nylon clip and bushing then pull out the lead wire from the chamber.

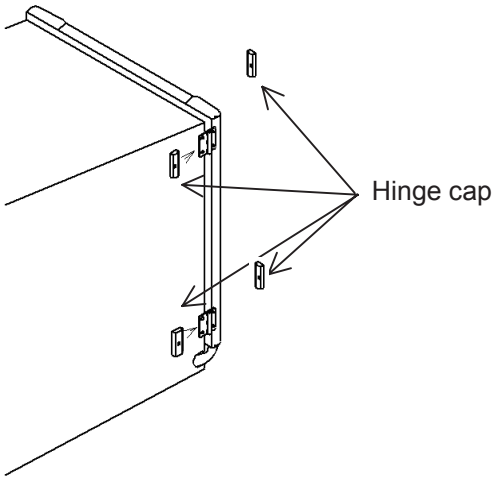
(4) Loosen and remove 4screws and remove 4hinge caps

Caution Rubber pads and brackets will be fallen off.

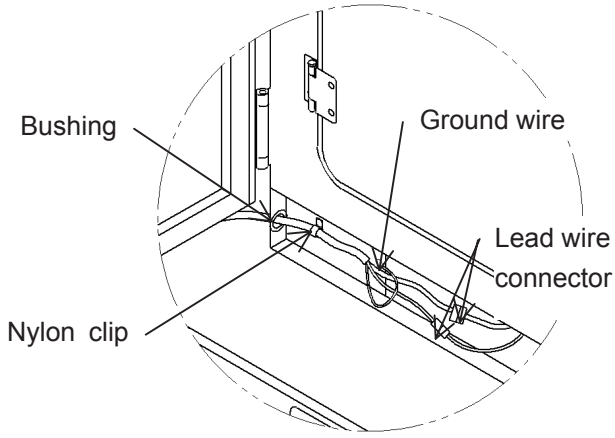
(5) Loosen and remove 8screws and remove the outer door.

Note Take care not to miss brackets.





<Details of circle-A>

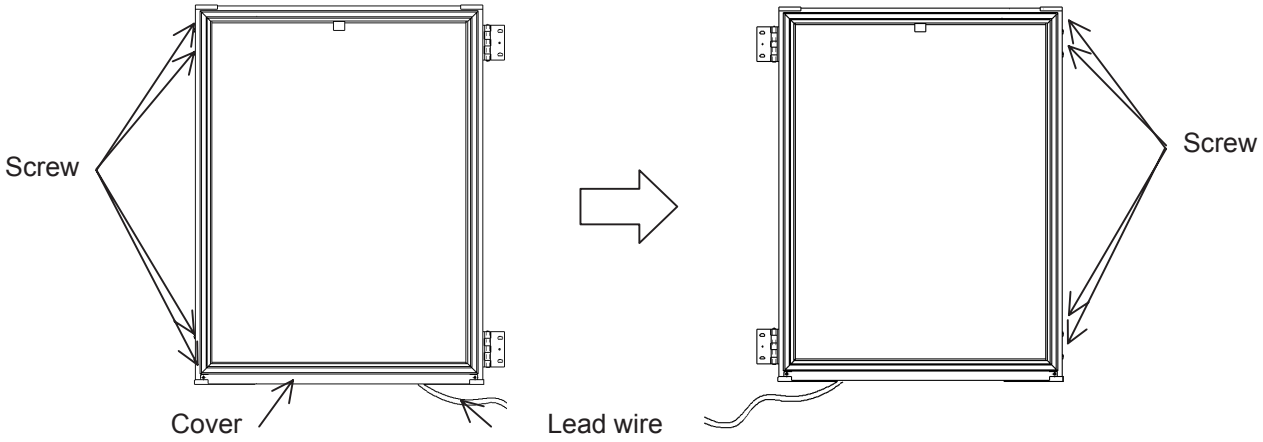


3. Outer door preparation

(1) Remove the cover from lower part of the outer door and pull out the lead wire to the opposite side. Install the cover back to the position.

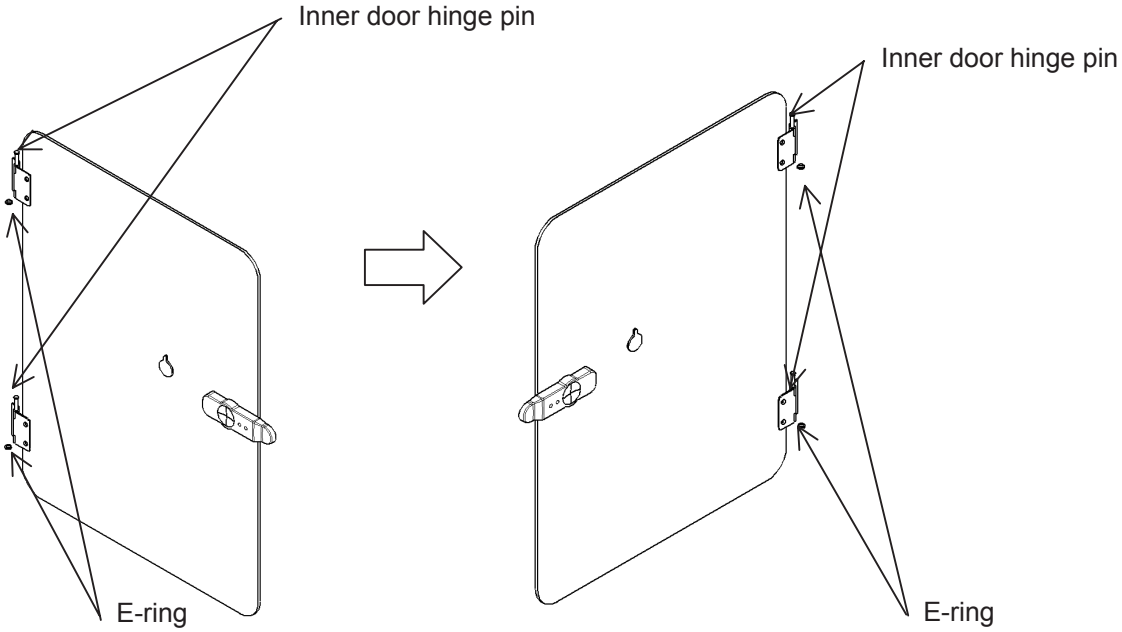
(2) Install the hinges and caps in the opposite side such as the picture below.

Note Torque: More than 80kgf/cm



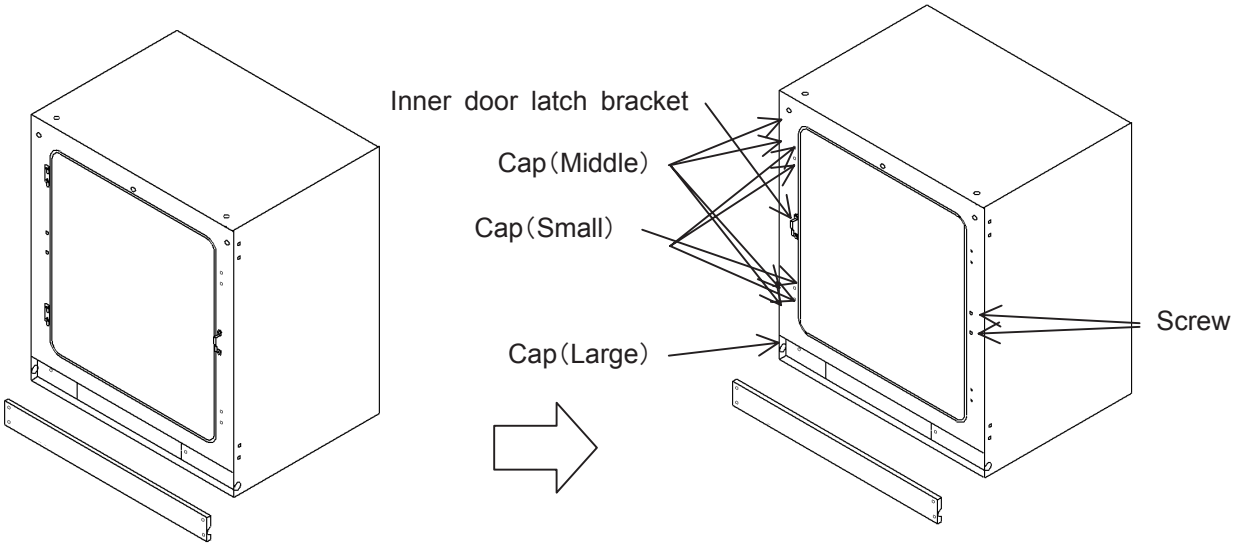
4. Inner door preparation

(1) Remove E-ring from inner door hinge pin then install inner door hinge in the opposite side such as the picture below. Fit the E-ring to the inner door hinge pin.



5. Unit preparation

Install the caps (Middle), caps (Small) and caps (Large), inner door latch bracket and screws in the opposite place, such as the picture below.



6. Installation of inner/outer door

(1) Install the outer door to the unit and connect the lead wire connectors and ground wire.
Hold wires by nylon clip.

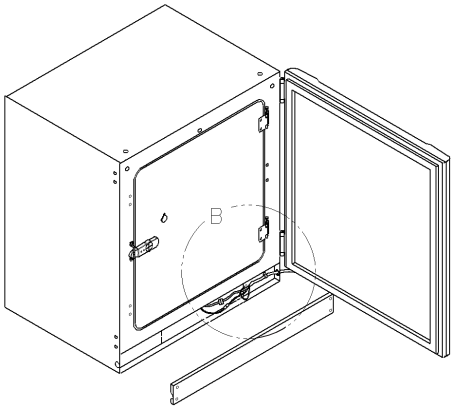
Note Take care not to become lead wires taut when the outer door is closed.

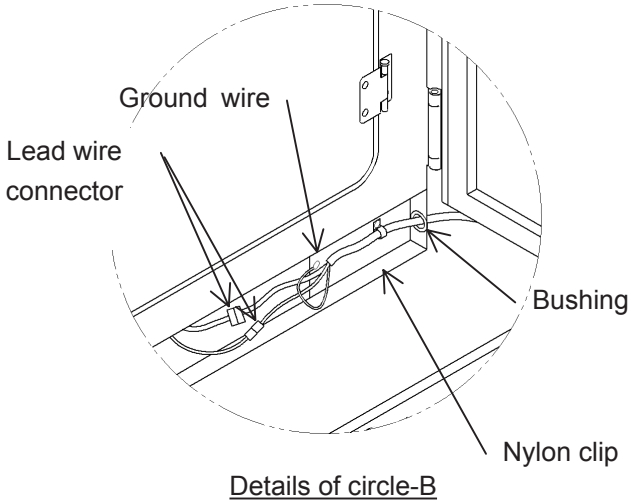
Note Torque: More than 80kgf/cm

(2) Install the bushing in the place where lead wires pull out from the chamber.
Install the frame panel back to the position.

(3) Install the inner door by tightening 4screws.

(4) Remove the caution sticker that is upside down. Put the new caution sticker on the specified place.

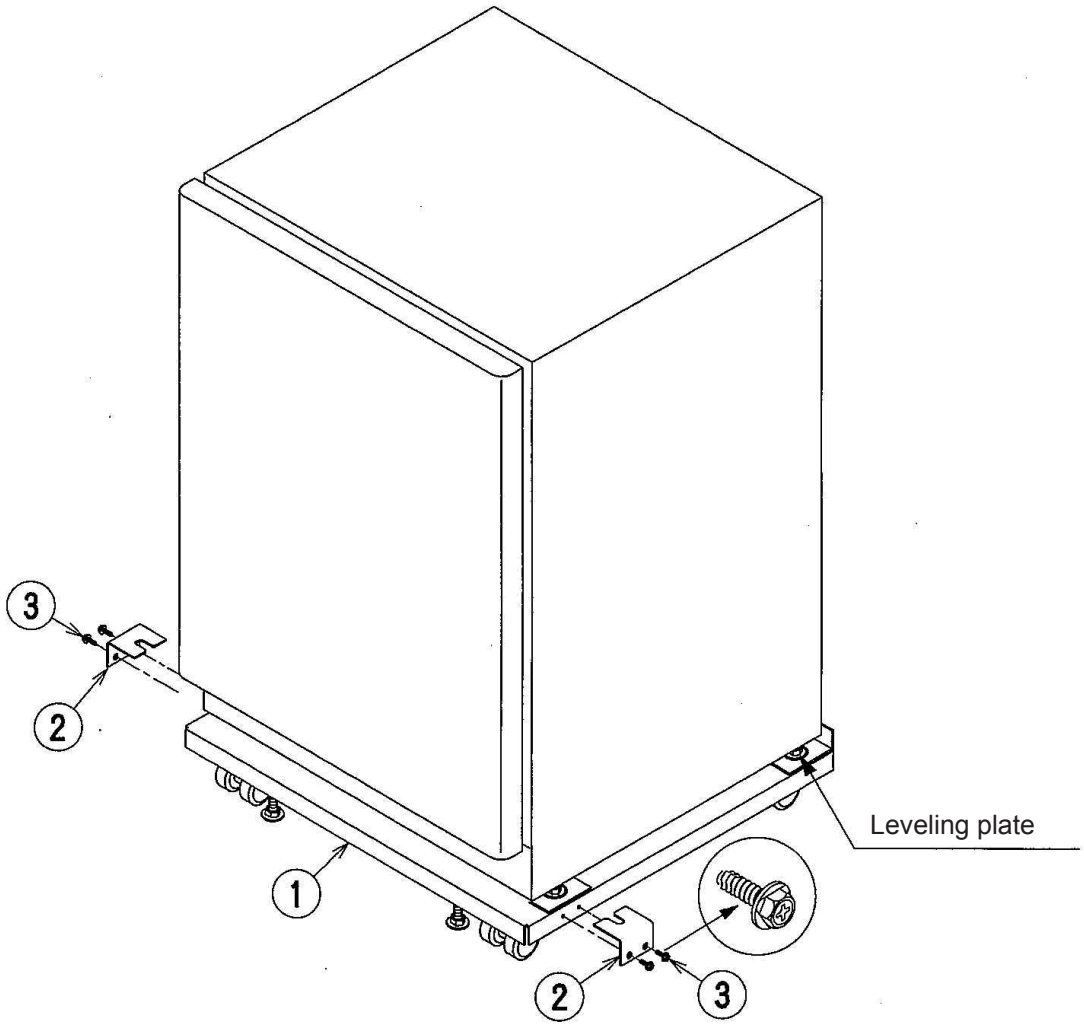




Details of circle-B

How to install Roller Base（MCO-18RB）

1. Align 4 pcs. of leveling plate on the Roller Base (①) to match them to each holes.
2. Fit the fixing metal（②） to each leveling plate and secure them by 2 screws（③）.



Instruction manual

・This section is extracted and printed from Instruction Manual.

・If you find out “Refer to page ●●” in them, this page means not page in Service manual but page in the lower corner of each page in the extract from Instruction Manual.
This page number is not corresponded with serial number in Service manual.

・**The attached Instruction Manual corresponds to the specifications for initial production, so the contents may be changed without notice.**

SANYO

INSTRUCTION MANUAL

MCO-18AC(UV)
MCO-18AC

CO_2 Incubator

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INTRODUCTION

■ Read this manual carefully before using the appliance and follow the instructions for safety operation.

■ Sanyo never guarantee any safety if the appliance is used for any objects other than intended use or used by any procedures other than those mentioned in this manual.

■ Keep this manual in an adequate place to refer to it as necessary.

■ The contents of the manual will be subjected to change without notice due to the improvement of performance or functions.

■ Contact Sanyo sales representative or agent if any page of the manual is lost or page order is incorrect.

■ Contact Sanyo sales representative or agent if any point in this manual is unclear or if there are any inaccuracies.

■ No part of this manual may be reproduced in any form without the expressed written permission of Sanyo.

⚠CAUTION

SANYO guarantees the product under certain warranty conditions. SANYO in no way shall be responsible for any loss of content or damage of content.

PRECAUTIONS FOR SAFE OPERATION

It is imperative that the user complies with this manual as it contains important safety advice.

Items and procedures are described so that you can use this unit correctly and safely. If the precautions advised are followed, this will prevent possible injury to the user and any other person.

Precautions are illustrated in the following way:

⚠WARNING

Failure to observe WARNING signs could result in a hazard to personnel possibly resulting in serious injury or death.

⚠CAUTION

Failure to observe CAUTION signs could result in injury to personnel and damage to the unit and associated property.

Symbol shows;

△ this symbol means caution.

⃠ this symbol means an action is prohibited.

● this symbol means an instruction must be followed.

Be sure to keep this manual in a place accessible to users of this unit.

< Label on the unit >

This mark is labeled on the cover in which the electrical components of high voltage are enclosed to prevent the electric shock.
The cover should be removed by a qualified engineer or a service personnel only.

⚠WARNING

As with any equipment that uses CO_2 gas, there is a likelihood of oxygen depletion in the vicinity of the equipment. It is important that you assess the work site to ensure there is suitable and sufficient ventilation. If restricted ventilation is suspected, then other methods of ensuring a safe environment must be considered. These may include atmosphere monitoring and warning devices.

⚠WARNING

Do not use the unit outdoors. Current leakage or electric shock may result if the unit is exposed to rain water.

Only qualified engineers or service personnel should install the unit. The installation by unqualified personnel may cause electric shock or fire.

Install the unit on a sturdy floor and take an adequate precaution to prevent the unit from turning over. If the floor is not strong enough or the installation site is not adequate, this may result in injury from the unit falling or tipping over.

Never install the unit in a humid place or a place where it is likely to be splashed by water. Deterioration of the insulation may result which could cause current leakage or electric shock.

Never install the unit in a flammable or volatile location. This may cause explosion or fire.

Never install the unit where acid or corrosive gases are present as current leakage or electric shock may result due to corrosion.

Always ground (earth) the unit to prevent electric shock. If the power supply outlet is not grounded, it will be necessary to install a ground by qualified engineers.

Never ground the unit through a gas pipe, water main, telephone line or lightning rod. Such grounding may cause electric shock in the case of an incomplete circuit.

Connect the unit to a power source as indicated on the rating label attached to the unit. Use of any other voltage or frequency other than that on the rating label may cause fire or electric shock.

Never store volatile or flammable substances in this unit if the container cannot be sealed. These may cause explosion or fire.

Do not insert metal objects such as a pin or a wire into any vent, gap or any outlet on the unit. This may cause electric shock or injury by accidental contact with moving parts.

Use this unit in safe area when treating the poison, harmful or radiate articles. Improper use may cause bad effect on your health or environment.

Turn off the power switch (if provided) and disconnect the power supply to the unit prior to any repair or maintenance of the unit in order to prevent electric shock or injury.

Do not touch any electrical parts (such as power supply plug) or operate switches with a wet hand. This may cause electric shock.

⚠WARNING

Ensure you do not inhale or consume medication or aerosols from around the unit at the time of maintenance. These may be harmful to your health.

Never splash water directly onto the unit as this may cause electric shock or short circuit.

Never put containers with liquid on the unit as this may cause electric shock or short circuit when the liquid is spilled.

Never bind, process, or step on the power supply cord, or never damage or break the power supply plug. A broken supply cord or plug may cause fire or electric shock.

Do not use the supply cord if its plug is loose. Such supply cord may cause fire or electric shock.

Never disassemble, repair, or modify the unit yourself. Any such work carried out by an unauthorized person may result in fire, or electric shock or injury due to a malfunction.

Disconnect the power supply plug if there is something wrong with the unit. Continued abnormal operation may cause electric shock or fire.

When removing the plug from the power supply outlet, grip the power supply plug, not the cord. Pulling the cord may result in electric shock or fire by short circuit.

Disconnect the power supply plug before moving the unit. Take care not to damage the power cord. A damaged cord may cause electric shock or fire.

Disconnect the power plug when the unit is not used for long periods. Keeping the connection may cause electric shock, current leakage, or fire due to the deterioration of insulation.

If the unit is to be stored unused in an unsupervised area for an extended period, **ensure that children do not have access and that doors cannot be closed completely.**

The disposal of the unit should be accomplished by appropriate personnel. Remove doors to prevent accidents such as suffocation.

Do not put the packing plastic bag within reach of children as suffocation may result.

⚠CAUTION

Use a dedicated power source (a dedicated circuit with a breaker) as indicated on the rating label attached to the unit. A branched circuit may cause fire resulting from abnormal heating.

Connect the power supply plug to the power source firmly after removing the dust on the plug. A dusty plug or improper insertion may cause a heat or ignition.

Never store corrosive substances such as acid or alkali in this unit if the container cannot be sealed. These may cause corrosion of inner components or electric parts.

Check the setting when starting up of operation after power failure or turning off of power switch. The stored items may be damaged due to the change of setting.

Be careful not to tip over the unit during movement to prevent damage or injury.

Prepare a safety check sheet when you request any repair or maintenance for the safety of service personnel.

LABELS ON THE INCUBATORS

Warning and caution labels are attached to the incubator. The following table describes the labels.

	This label is attached to covers that access high-voltage electrical components to prevent electric shock. Only a qualified engineer or service personnel should be allowed to open these covers.
	This symbol indicates an ultraviolet light (UV) caution.
	This symbol indicates that caution is required. Refer to product documentation for details.
	This symbol indicates a hot surface.
	This symbol indicates an earth.
	This symbol means “ON” for a power switch.
	This symbol means “OFF” for a power switch.

ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe at least under the following conditions (based on the IEC 61010-1):

■ Indoor use;

■ Altitude up to 2000 m;

■ Ambient temperature 5°C to 40°C

■ Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C;

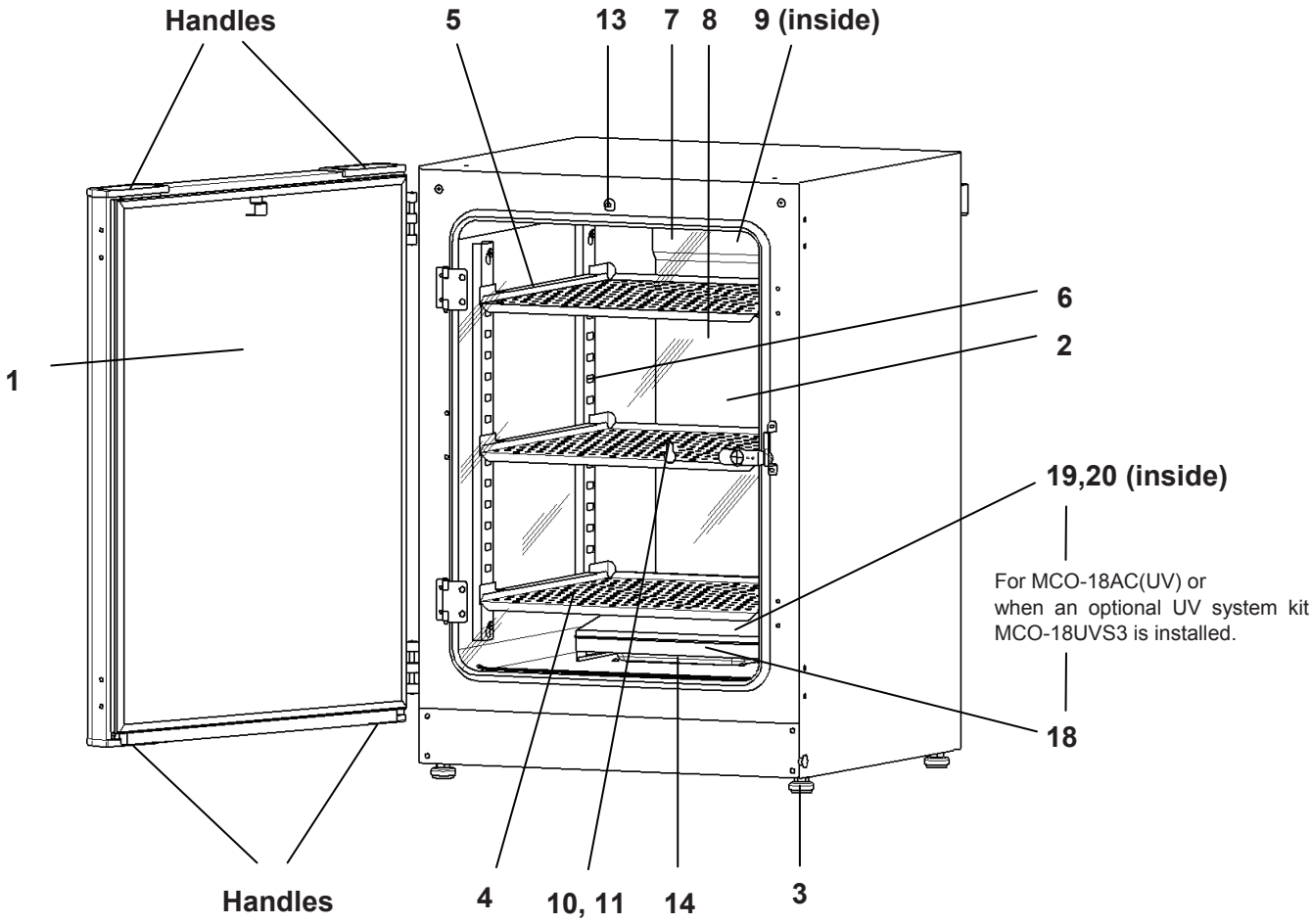
■ Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage;

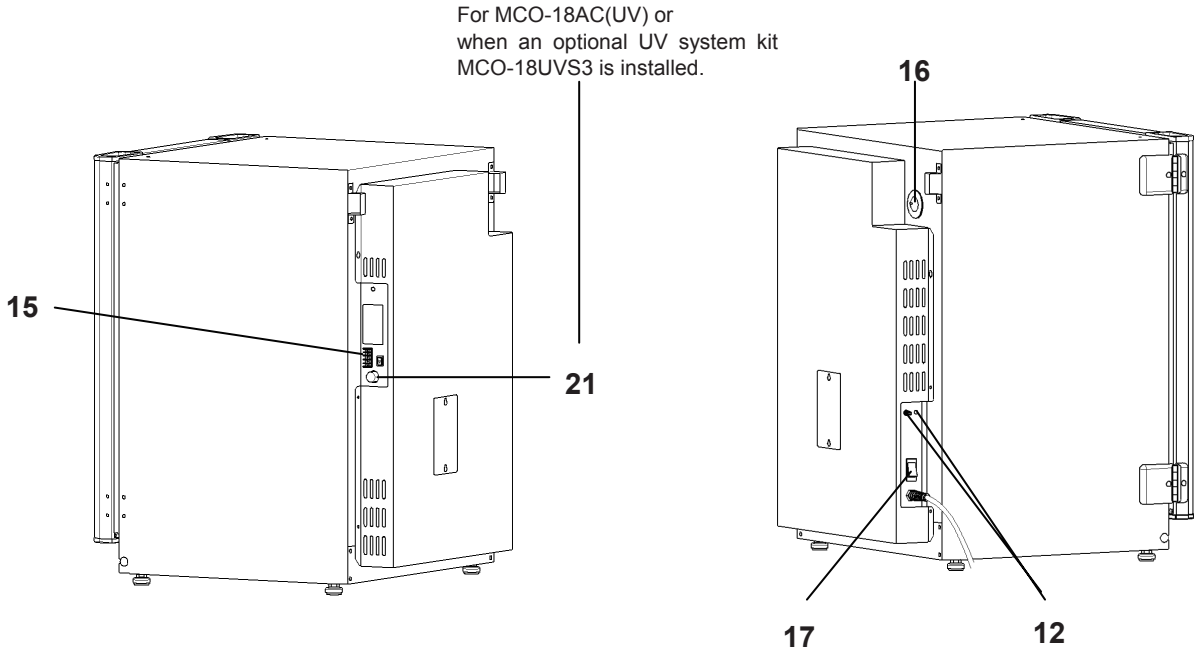
■ Other supply voltage fluctuations as stated by the manufacturer;

■ Transient overvoltages according to Installation Categories (Overvoltage Categories) II; For mains supply the minimum and normal category is II;

■ Pollution degree 2 in accordance with IEC 60664.

INCUBATOR COMPONENTS





Rear Right Side

Rear Left Side

1. Outer door: Sticks to frame with magnetic seal. Door heater is installed in the outer door panel. The door opening is reversible. Contact Sanyo representative or agent to change the door hinge from left to right or vice versa.

2. Inner door: Made of tempered glass, however avoid excessive impact on the glass.

3. Leveling foot: Screw type for adjusting the height. Adjust the foot so that the incubator can be level.

4. Tray: Can be pulled toward you.

5. Tray support: Can be removed by lifting the front side and pulling toward you.

6. Side support: Right and left side supports can be removed for disinfection. See page 27, 28 and 29.

7. Fan cover: Inlet of circulating air. Removable.

8. Duct: Flow path for circulating air. Removable.

9. Fan (inside the rear duct): Made from polypropylene resin. Can be disinfected by an autoclave.

10. Sample air outlet: This also functions as an internal gas outlet. Normally, cover this outlet with the sample air outlet cap.

11. Sample air outlet cap: Always attach this cap except at the time of using of sample air outlet.

Note: Operation without sample air outlet cap may result low humidity or condensation on the outer door.

12. Connecting port for CO_2 gas pipe: When an optional component MCO-21GC (automatic CO_2 cylinder changeover system) is installed, both A and B are available. If MCO-21GC is not used, only A is available. Refer to page 14 for gas cylinder connection. Ensure that the gas pressure is set at 0.03 MPaG (0.3 kgf/cm^{2}G, 4.3 psiG). Refer to page 39 for automatic CO_2 cylinder changeover system.

13. Door switch: Detects the door opening/closing and stops the circulating fan, UV lamp* and electromagnetic valve for CO_2 when door is open.

14. Humidifying pan: Use sterile distilled water to fill the pan. (MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed) Install the pan properly so that it can be covered with the pan cover.

15. Remote alarm terminal: Refer to page 11.

16. Access port: When not in use, cap with the silicon caps on both outside and inside.

17. Power switch: Main switch of the incubator. Also functions as an over-current breaker. The switch is covered by a switch cover to prevent the accidental push. To turn on or off the switch, remove the switch cover by loosening the screw.

18. Humidifying pan cover*: Prevents UV light being exposed to the chamber. When filling the pan, lift the front side and take out the pan. See page 30 for details.

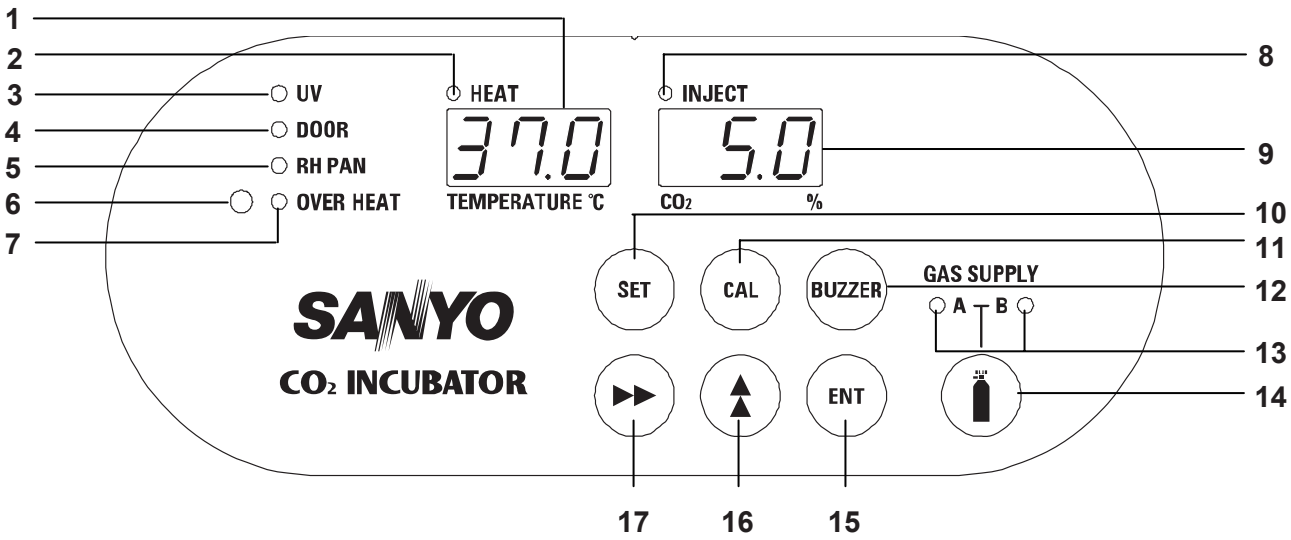
19. UV lamp*: Sanyo UV lamp does not generate ozone. Never look at the UV light directly. For replacement, contact Sanyo sales representative or agent.

20. Water level sensor for humidifying pan*: Detects the water level in the humidifying pan. See page 24 for details.

21. Glow starter*: For UV lamp (model; FG-7P)

*MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed.

Control panel and keypad



1. Digital temperature indicator (TEMPERATURE °C): Normally, this indicator shows the chamber temperature. In the setting mode, it shows the set value of the chamber temperature. If the self diagnostic function detects any abnormality, an error code will be displayed.

2. Heater lamp (HEAT): This lamp lights when the heater is energized.

3. UV indicator (UV): This lamp lights when the UV lamp is ON. The blink of this indicator recommends the replacement of UV lamp. See page 19 for the details. MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed.

4. Door lamp (DOOR): This lamp lights when the outer door is open.

5. Water level alarm lamp (RH PAN): This lamp blinks when the water in the humidifying pan is less than approximately 0.8 liter. MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed.

6. Upper limit regulator: This regulator is used to set the upper temperature limit.

7. Over heat lamp (OVER HEAT): This lamp lights when the chamber temperature reaches the upper limit set value.

8. CO_2 inject lamp (INJECT): This lamp lights when CO_2 gas is being injected.

9. Digital CO_2 density indicator (CO_2 %): Normally, this indicator shows the CO_2 concentration in the chamber. In the setting mode, it indicates the set value of the CO_2 concentration. In the calibration mode, the decimal point in the digital CO_2 density indicator blinks.

10. Set key (SET): Pressing this key to enter the setting mode, and the digits to be set will blink.

11. Calibration key (CAL): Pressing this key to enter the CO_2 calibration pre-conditioning mode. Normally when the outer door is opened, the fan motor will stop operating. This mode allows the fan motor to continue to circulate the chamber environment to ensure accurate CO_2 uniformity inside the chamber. At this time, by pressing this key for approximately 5 seconds, the incubator enters the temperature calibration input mode. And then pressing this key again, the incubator enters the CO_2 calibration input mode. See page 31 and 32 for the details. Also, used to change the UV lamp ON period. See page 21 for the details.

Note:

This operation affects the basic performance. When calibrating the CO_2 density, contact a Sanyo sales representative or agent.

12. Alarm buzzer stop key (BUZZER): Press this key to silence the buzzer when the alarm operates and the buzzer sounds (The remote alarm is not stopped).

13. CO_2 gas supply line indicator (A/B): The lamp for the supply line currently in use lights up provided that MCO-21GC automatic CO_2 cylinder changeover system (option) is installed.

14. CO_2 gas supply line switching key : This key to select CO_2 gas supply line is available only when an automatic CO_2 cylinder changeover system MCO-21GC (option) is installed. When one CO_2 cylinder is empty, the CO_2 is supplied by the other cylinder automatically.

15. Enter key (ENT): Pressing this key memorizes the set value in the controller.

16. Numerical value shift key (⏫): Pressing this key in the setting mode causes the numerical value to shift. In key lock mode, pressing this key makes key lock ON or OFF. See page 23 for details.

17. Digit shift key (⏩): Pressing this key in the setting mode causes the changeable digit to shift. Pressing this key more than 5 seconds enters key lock mode. See page 23 for the key lock.

Remote alarm terminal

The terminal of the remote alarm is installed at the rear right side of the incubator. The alarm is outputted from this terminal. Contact capacity is DC 30 V, 2 A.

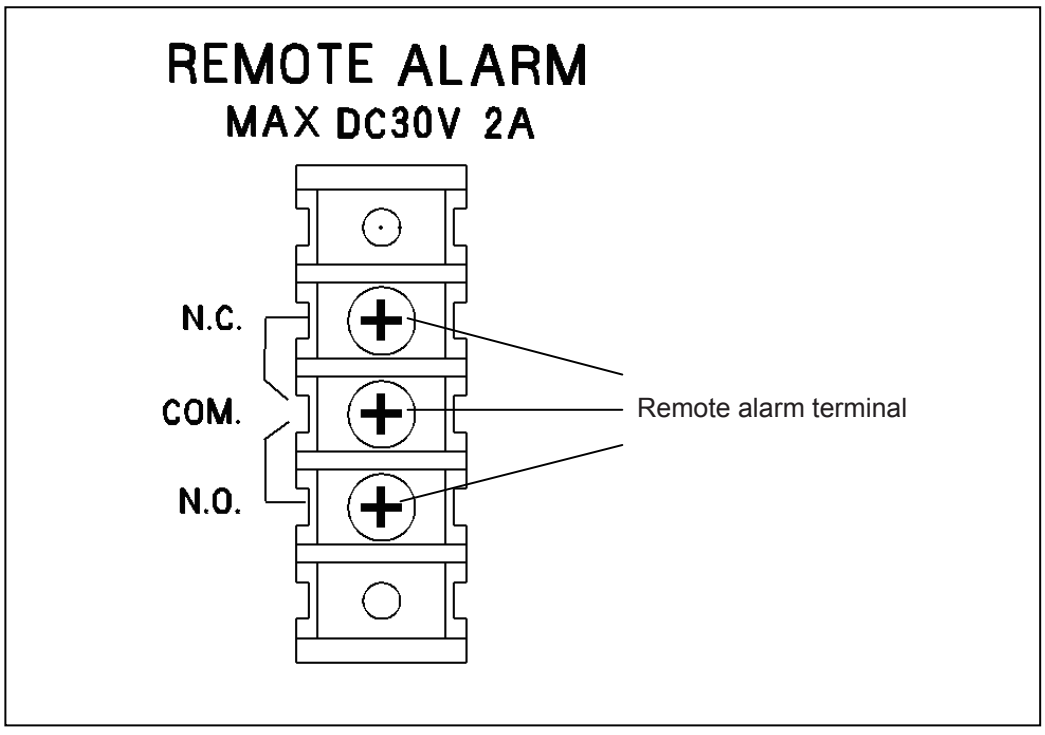
Contact output:

	between COM. and N.O.	between COM. and N.C.
At normal	Open	Close
At abnormal	Close	Open

Note:

The alarm is actuated when the power cord is disconnected from the outlet or the power switch is OFF.

• The remote alarm cannot be stopped by pressing the alarm buzzer stop key (BUZZER) since the remote alarm is not conjunct with the alarm buzzer stop key (BUZZER).



INSTALLATION SITE

To operate this incubator properly and to obtain maximum performance, install the incubator in a location with the following conditions:

> ⚠ **WARNING**
>
> **Ventilate a room air occasionally when using CO_2 gas for control.** The gas density will increase in an enclosed small room and high level of gas density can be hazardous to health. In addition, avoid inhaling the chamber air directly when opening the door if CO_2 gas is used.
> Si l'appareil est utilisé dans un evdroit restreint, le niveau de la densite CO_2 de l'air peut s'élever et peut être nocif aux humains. Evitez d'aspirer l'air provenant de l'inérieur de l'appareil quand vous ouverz la porte.

■ A location not subjected to direct sunlight

Do not install the incubator under direct sunlight. Installation in a location subjected to direct sunlight cannot obtain the intended performance.

■ A location away from heat generating sources

Avoid installing the incubator near heat-emitting appliances such as a heater or a boiler etc. Heat can decrease the intended performance of the incubator.

■ 5°C higher than the ambient temperature

The chamber temperature must be at least 5°C higher than the ambient temperature. For example, the chamber temperature is set to 37°C, the ambient temperature must be less than 32°C. Keep the ambient temperature in adequate range.

■ A location with a sturdy and level floor

Always install the incubator on a sturdy and level floor. The uneven floor or tilted installation may cause failure or injury. Install the incubator in stable condition to avoid the vibration or noise. Unstable condition may cause vibration or noise.

> ⚠ **WARNING**
>
> **Install the incubator on a sturdy floor.** If the floor is not strong enough or the installation site is not adequate, this may result in injury from the incubator falling or tipping over.
> **Select a level and sturdy floor for installation.** This precaution will prevent the incubator from tipping. Improper installation may result in water spillage or injury from the incubator tipping over.

■ A location not prone to high humidity

Install the incubator in the ambient of 80% R.H. or less humidity. Installation under high humidity may cause current leakage or electric shock.

> ⚠ **WARNING**
>
> **Do not use the incubator outdoors.** Current leakage or electric shock may result if the incubator is exposed to rain water.
> **Never install the incubator in a humid place or a place where it is likely to be splashed by water.** Deterioration of the insulation may result which could cause current leakage or electric shock.

■ A location without flammable or corrosive gas

Never install the incubator in a flammable or corrosive location. This may cause explosion or fire or may result in the current leakage or electric shock by the corrosion of the electrical components.

INSTALLATION

1. Remove the packaging materials and tapes

Remove all transportation packaging materials and tapes. Open the doors and ventilate the incubator. If the outside panels are dirty, clean them with a neutral detergent and wipe it up with a wet cloth.

⚠WARNING

Do not put the packing plastic bag within reach of children as suffocation may result.

2. Adjust the leveling feet

Extend the leveling feet by rotating them counterclockwise to contact them to the floor. Ensure the incubator is level.

3. Fix the incubator

Two fixtures are attached to the rear of the frame. Fix the frame to the wall with these hooks and rope or chain.

4. Ground (earth)

⚠WARNING

Use a power supply outlet with ground (earth) to prevent electric shock. If the power supply outlet is not grounded, it is necessary to install a ground by qualified engineers.

Never ground the incubator through a gas pipe, water main, telephone line or lightning rod. Such grounding may cause electric shock in the case of an incomplete circuit.

● Stacked module

When the product is used in stacked module, make sure to fix the incubator by using the stacking kit

⚠WARNING

Do not climb onto the incubator and do not put articles on the incubator. This may cause injury by tipping or damage to the incubator. When stacking the incubator, follow the procedure shown on page 40.

● If not used

When the incubator is not used, dispose the water in the humidifying pan and remove any moisture in the chamber completely. Check that the chamber is completely dry before closing the doors.

● Before moving the incubator

Empty the humidifying pan completely before moving the incubator. Spilled or splashed water may cause current leakage or electric shock.

Connection of CO_2 gas cylinder

⚠WARNING

Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of CO_2 gas. Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death.

1. Use a liquefied CO_2 gas cylinder, not a siphon (dip tube) type. The CO_2 gas should be 99.5% or more pure.

2. Install a gas pressure regulator (optional accessory MCO-100L) on the cylinder. Use a regulator rated at 25 MPaG (250 kgf/cm^{2}G, 3600 psiG) on the primary side and 0.2 MPaG (2.0 kgf/cm^{2}G, 30 psiG) on the secondary side.

3. Using the gas supply pipe provided, connect the CO_2 gas pressure regulator to the connecting port for CO_2 gas pipe located at the rear left side of the CO_2 incubator.

Note:

If CO_2 is supplied to multiple CO_2 incubators from a single gas cylinder, a CO_2 solid will be formed in the gas pressure regulator. The gas pressure regulator safety valve will operate, and there may an explosive sound.

When the MCO-21GC is not mounted

Using the gas supply pipe that is provided, connect the CO_2 gas pressure regulator for the CO_2 gas cylinder to CO_2 gas pipe connection port A on the incubator. After connecting the pipe, check to make sure that no gas is leaking.

When the MCO-21GC is mounted

Connect a pair of CO_2 gas cylinders with CO_2 gas pressure regulators independently. The gas supply line will be switched automatically. Connect the main cylinder to port A and the reserve cylinder to port B. After connecting the cylinders, check to make sure that no gas is leaking.

4. Set the CO_2 pressure on the secondary side to 0.03 MPaG (0.3 kgf/cm^{2}G, 4.3 psiG) (at gas injection). Excessive pressure may cause disconnection of internal pipes inside the CO_2 incubator which will result in leakage of CO_2 gas into the atmosphere. **Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death.** The repair of the incubator will be necessary if the internal pipe is disconnected.

4. Check that no gas is leaking at any point where the pipe connects with the CO_2 regulator or the CO_2 incubator.

Note:

The incubator, including the gas supply pipes and services must be examined at frequent intervals to ensure they are safe. Ensure that items such as pipes are replaced if there is any sign of deterioration.

PREVENTING CONTAMINATION

To prevent contamination of the chamber, select an appropriate location for installation as well as the complete disinfection of the chamber components.

● Avoid hot and humid location

Avoid location with high temperature and/or humidity as the presence of bacteria in the air is greater than in normal environment.

● Avoid drafty location and location with many passers-by

Avoid locations near doors, air conditioners, fans, etc., where slight breezes can facilitate the entry of bacteria into the chamber.

● Installation in a sterile room

To get the cultivation more efficiently, install the incubator in a sterile room.

● Use clean containers

The contamination is mainly caused by the containers such as Petri dishes or bottles stored in the chamber. Always keep the containers clean.

● Always keep the chamber clean

The condensation may be caused on the inside of the door by spilled water form humidifying pan or opening of outer door for long period. Wipe off the condensation completely with a sterile dry gauze. Especially when the culture medium is spilled, clean and disinfect the chamber immediately. Refer to page 27 “Routine maintenance” for details.

● Keep the inside panels dry

To protect the inside of the incubator from contamination, the inside panels should always be kept dry. If water is spilled from a humidifying pan or if the door is kept open for a long period, condensation will form on the panels, allowing germs to breed. In such a case, wipe away the water with a dry sterile gauze. Particularly, if the medium is spilled, wipe it up immediately and sterilize the area.

● Fill the humidifying pan with sterile distilled water

Always use sterile distilled water to fill the pan. The water level alarm lamp (RH PAN) on the control panel blinks when the water level is low. Refill the sterile distilled water to the pan when the water level alarm lamp (RH PAN) blinks. Note that when low temperature sterile distilled water is poured, the chamber temperature drops significantly. Clean the humidifying pan once a month.

● Do not place the incubator in the direct air flow from an air conditioning system

Air from an air conditioning system may cause condensation and lead to possible contamination.

PRECAUTIONS FOR CULTURES

● Do not subject to direct air flow

Do not allow the air for air conditioning to hit the incubator or door directly. Direct hit may cause condensation or contamination.

● Allow adequate space between the cultures

When storing cultures in the chamber, keep the Petri dishes or bottles containing the cultures sufficiently apart from each other to allow adequate air circulation. Inadequate space may result in uneven temperature distribution and CO_2 concentration in the chamber.

● Stored materials

Never place acid or alkaline materials or materials that release corrosive gas in the chamber. Such materials can cause failure resulting from discoloration or corrosion.

● Always shut the inner door

Shut the inner door completely, and then shut the outer door. If the inner door is not closed completely, even if the outer door is closed, the incubator will fail to exhibit its maximum performance. And close the doors gently. Rude closing may cause spillage of medium, incomplete closing, or damage of gasket.

● Open/close the doors gently

Ensure you close the doors gently. Robust closing may cause spillage of medium, incomplete closing, or damage of gasket. Also, before opening the inner door, check that the UV light is OFF (MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed).

● Take care of the inside of the outer door.

It may get hot.

● Never lean or press on the glass.

Broken glass due to intentional force may cause injury.

● Alarm

Always investigate the cause and fix the alarm condition immediately when the alarm is activated. Refer to page 25 for alarm details.

● Fix the tray supports and trays securely

Incomplete installation may cause injury or damage.

START-UP OF INCUBATOR

When start the test operation or the operation, follow these steps as below.

1. Install the incubator referring to “INSTALLATION” on page 13.

2. Remove all transportation packaging materials and tapes on the attachments in the chamber. Then clean and sterilize the chamber and inner attachments. Refer to “Cleaning the chamber and inner attachments” on page 27.

3. Add approximately 1.5 L of sterile distilled water to the humidifying pan. (Refer to page 30.)

4. Turn ON the power switch on the rear left side.

Note:
The humidity in the incubator chamber is adjusted to the optimum setting. To prevent condensation on the surface inside chamber and the inner door, there is a low-temperature area under the humidifying pan in the bottom of chamber to recondense evaporated moisture. Condensation may occur around the humidifying pan at the bottom of the chamber, but this does not indicate a problem.

SETTING THE CHAMBER TEMPERATURE AND CO_2 DENSITY

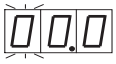
Table below shows the basic procedure for setting the chamber temperature and CO_2 density. The upper limit alarm temperature setting is also shown in the table. Perform key operations in the sequence indicated in the table. The example in the table is based on the assumption that the desired temperature is 37°C and CO_2 density is 5%. Adjustment of the upper limit regulator should be executed after the chamber temperature reaches the stable condition.

Note:

• The incubator is set at the factory so that the chamber temperature is 37°C and CO_2 density is 0%.

• When starting the incubator for the first time or after not using it for an extended period of time, allow at least 8 hours for the chamber temperature, humidity, and CO_2 sensor to become stable after setting the desired chamber temperature at 0% CO_2 density. Then change the setting to the desired CO_2 density.

Basic operation sequence (Example: Chamber temperature: 33°C, CO_2 density: 5%)

	Description of operation	Key operated	Indication after operation
1	Turn the power switch ON.	----	The current chamber temperature is displayed in the digital temperature indicator.
2	Press set key.	SET	The left digit blinks.
3	By pressing numerical value shift key and digit shift key, set the figure to 37.0.	▶▶	When pressed, the changeable digit is shifted.
		▲▲	When pressed, the figure of settable digit changes.
4	Press enter key.	ENT	Set temperature is memorized. Left digit in the digital CO_2 density indicator blinks. 
5	By pressing digit shift key and numerical value shift key, set the figure to 05.0.	▶▶	When pressed, the changeable digit is shifted.
		▲▲	When pressed, the figure of settable digit changes.
6	Press enter key.	ENT	Set CO_2 density is memorized.
7	(Executed after the chamber temperature reaches the stable condition) Adjust upper limit regulator so that the alarm temp. is 1°C higher than set temperature.	----	In the digital CO_2 density indicator, HI is displayed. In the digital temperature indicator, upper limit temp. is displayed. The upper limit temp. can be changed by turning upper limit regulator.
8	Press enter key.	ENT	This is the end of set mode and the indicators display current temperature and CO_2 density.

Note:

● In each set mode, if the change of the setting is not necessary, pressing set key (SET) skips to next set mode.

● When the CO_2 density is set to 00.0, the control is OFF regardless of chamber density.

● The upper limit temperature set value will change when the regulator is turned even if the incubator is not in set mode, because the alarm circuit is an independent circuit.

● In each set mode, the indicator returns to the current temperature and CO_2 density display mode automatically when 90 seconds has passed without any key operation.

UV LAMP(MCO-18AC(UV) or MCO-18AC with MCO-18UVS3)

The clauses below are applicable when the model is MCO-18AC(UV) or an optional UV system kit MCO-18UVS3 is installed.

A UV lamp is located inside the duct to sterilize the water in the humidifying pan and air circulating in the chamber.
Following shows precautions and instructions about the UV lamp.

● When all chamber attachments are installed correctly, only the inside of the duct and the inside of the humidifying pan cover are exposed to UV light.

● Correctly install all of the chamber attachments when starting a cell culture, and never turn ON the UV lamp when the humidifying pan cover is removed.

● Always install the humidifying pan cover even when using the incubator without turning ON the UV lamp. Leaving the cover uninstalled will affect the chamber temperature distribution and the humidity recovery performance.

● The UV lamp stays lit for a preset period of time after the outer door is closed. The default setting is for 5 minutes. The period can be changed when necessary as shown in the page 21.

● If the outer door is not opened for at least 12 consecutive hours, the UV lamp will light for the preset time period every 12 hours. The period can be changed when necessary as shown in the page 21.

● When checking the UV lamp operation, open the outer door and push the door switch with the inner door closed. The visible blue light can be checked under the humidifying pan cover. The UV light is harmful to eyes. Never turn on the UV light with the inner door or humidifying pan cover opened.

● The recommended replacement time for the UV lamp (i.e., when the UV output ratio drops to approx. 70% of its initial value) is when the accumulated ON time reaches 1,000 hours. When the accumulated ON time reaches approximately 1,000 hours, the UV indicator blinks (when the UV lamp is not lit). It is recommended that the UV lamp be quickly replaced at this point. Contact a Sanyo sales representative or agent for information on replacing the UV lamp.

● If the UV lamp burns out, E18 is displayed on the digital temperature indicator. If this occurs, replace the UV lamp. When replacing the UV lamp, replace the glow starter (type FG-7P) at the same time. Contact a Sanyo sales representative or agent for information on replacing the UV lamp.

Precautions when using the UV lamp

The clauses below are applicable when the model is MCO-18AC(UV) or an optional UV system kit MCO-18UVS3 is installed.

⚠WARNING

Do not look directly at UV light. UV light is harmful to the eyes.

● **Always use the humidifying pan and humidifying pan cover.**

The humidifying pan and cover prevent UV light from escaping. Always use them even when not humidifying. To check whether the UV lamp is lit, open the outer door and then press the door switch with the inner door still closed. Visible blue light can be confirmed from the front of the humidifying pan cover. UV light is harmful to the eyes, so do not light the UV lamp when the inner door or humidifying pan cover is open.

● **Be careful when handling the UV lamp.**

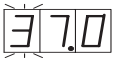
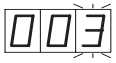
There is a UV lamp inside of the duct. Be careful not to damage it when installing or removing chamber attachments or the humidifying pan.

Setting the UV lamp ON period

The clauses below are applicable when the model is MCO-18AC(UV) or an optional UV system kit MCO-18UVS3 is installed.

Follow the procedure below when changing the setting of the UV lamp ON period.

Basic operation sequence (Example: change of UV lamp ON period from 5 minutes to 3 minutes)

	Description of operation	Key operated	Indication after operation
1	Press calibration key for 5 seconds.	CAL	The left digit in the digital temperature indicator is blinked. 
2	By pressing numerical value shift key and digit shift key, set the figure to F01.	▲▲	When pressed, the figure of settable digit changes.
		▶▶	When pressed, the changeable digit is shifted.
3	Press enter key.	ENT	The current setting is displayed in the digital CO_2 density indicator.
4	By pressing numerical value shift key and digit shift key, set the figure to 003.	▲▲	When pressed, the figure of settable digit changes. 
5	Press enter key.	ENT	Set value is memorized and the display return to normal display mode.

- The UV timer can be set from 0 to 30 min. The default setting is for 5 min. When the UV timer is set to zero, the UV lamp will not light.
- If the outer door is opened while the UV lamp is lit, the lamp will turn OFF. Then, when the door is closed, the lamp will light for the preset period of time.
- If the UV lamp ON time is set for longer than 5 minutes or if only the outer door is repeated opened and closed, condensation may occur in the chamber and may affect temperature distribution. It will also shorten the service life of the UV lamp.
- When replacing the UV lamp, contact a Sanyo sales representative or agent.

Pressing calibration key (CAL) for about 5 seconds leads the calibration mode. In the calibration mode, the calibration of temperature and CO_2 density is possible. Wrong key operation affects the basic performance. Never touch any other keys on the control panel in the event of pressing calibration key (CAL) accidentally. After about 90 seconds, the incubator returns to chamber temperature display mode automatically.

Lighting the UV lamp for 24 hours

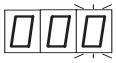
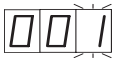
The clauses below are applicable when the model is MCO-18AC(UV) or an optional UV system kit MCO-18UVS3 is installed.

If the chamber has been contaminated by dirt or by spilling the medium, use the following procedure to decontaminate the chamber by lighting the UV lamp for 24 hours.

1. Remove all attachments from the chamber, including the trays, tray supports, side supports, fan cover, duct, fan, humidifying pan, and humidifying pan cover. Clean all the attachments in an autoclave or with disinfectant alcohol.

2. Clean and wipe off inside the chamber with disinfectant alcohol.

3. Set the CO_2 density to 0% and set the UV 24-hour lighting mode.

	Description of operation	Key operated	Indication after operation
1	Press calibration key for 5 seconds.	CAL	The left digit in the temperature indicator blinks.
2	By pressing numerical value shift key and digit shift key, set the figure to F02.	▲▲	When pressed, the figure of settable digit changes.
		▶▶	When pressed, the changeable digit is shifted.
3	Press enter key.	ENT	"000" is displayed in the digital CO_2 density indicator. 
4	By pressing numerical value shift key, set the figure to 001.	▲▲	When pressed, the figure of settable digit changes. 
5	Press enter key.	ENT	Set value is memorized and the display returns to normal display mode.

・This procedure must be preformed only with the outer door closed and the UV lamp turned OFF.
・The UV lamp will light continuously for 24 hours after this parameter is set. The setting is canceled if the outer door is opened. Perform the above procedure to set the 24-hours lighting mode again when opening the outer door.
・The incubator keeps running with set temperature and CO_2 density during UV lighting.
・Install the attachments after completion of the 24-hour lighting mode.

Note: Set the upper limit alarm temperature to at least 10°C higher than the chamber set temperature when using the 24-hour lighting mode of UV lamp. The 24-hour lighting mode may cause an automatic chamber temperature alarm because the temperature of the chamber will increase.

Pressing calibration key (CAL) for about 5 seconds leads the calibration mode. In the calibration mode, the calibration of temperature and CO_2 density is possible. Wrong key operation affects the basic performance. Never touch any other keys on the control panel in the event of pressing calibration key (CAL) accidentally. After about 90 seconds, the incubator returns to chamber temperature display mode automatically.

KEY LOCK FUNCTION

This incubator is provided with a key lock function. When the key lock is ON, change of temperature or CO_2 density setting through the key pad is not available.

Note: The key lock is set in OFF mode (L0) at the factory.

Display	Mode	Function
L0	Key lock is OFF	Enable to change of temperature and CO_2 setting
L1	Key lock is ON	Disable to change of temperature or CO_2 setting

Procedure for key lock setting (change from key lock OFF to key lock ON)

	Description of operation	Key operated	Indication after operation
1		----	The current chamber temperature and CO_2 density are displayed.
2	Press digit shift key for 5 seconds.	⏩	L0 is displayed in the temperature indicator.
3	Press numerical value shift key and scroll the figure to 1.	⏫	When pressed, the figure of settable digit changes.
4	Press enter key.	ENT	The key lock is set to ON. The current chamber temperature is displayed.

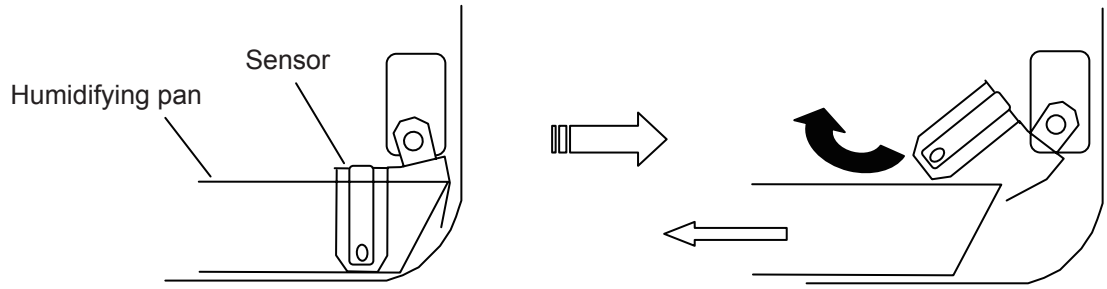
Note:

- The key lock function is available for temperature and CO_2 density setting.
- To cancel the key lock, set to L0 in the above procedure.

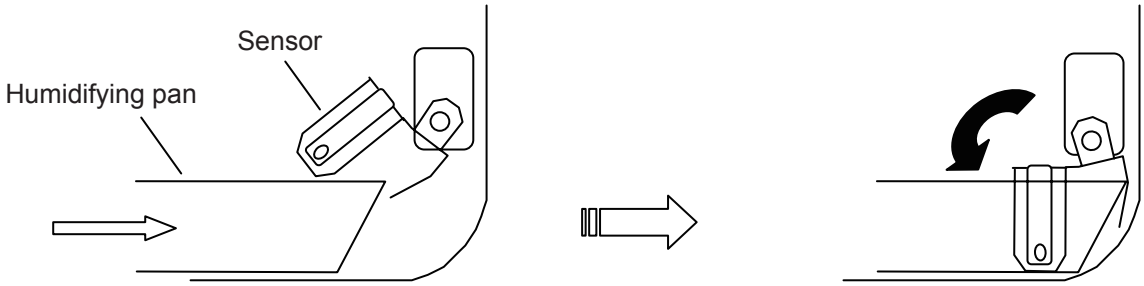
WATER LEVEL SENSOR (MCO-18AC(UV) or MCO-18AC with MCO-18UVS3)

Water level sensor for the humidifying pan is used with the MCO-18AC(UV) or the MCO-18AC with an optional UV system kit MCO-18UVS3 installed. The sensor is set in active position with respect to the installation of the humidifying pan. Take care not to damage the sensor at the time of removal or installation of the humidifying pan.

When the humidifying pan is removed (side view)



When the humidifying pan is installed (side view)



Note: At the installation, check the humidifying pan is located far depth and the sensor is down.

Note:

• Lift the sensor before installing the humidifying pan if the sensor is in lower position after maintenance.

• At the time of installation of humidifying pan, check that the pan is set properly and sensor is down in the pan. The water level alarm lamp (RH PAN) blinks if the sensor is not down completely. In this case, set the pan again in adequate location.

• The sensor detects the water level every 30 minutes. In addition, detection is executed after operation of the outer door. It takes several seconds to detect the water level. Therefore, the water level alarm lamp may blink a few times after the outer door is closed with the humidifying pan filled sufficiently.

⚠CAUTION

The foreign particles on the water surface adhere to the water level sensor and its fittings by the capillary action because the sensor is always in the water. The adhered foreign particles degrade the sensor performance and the water level alarm lamp may blink with the enough water in the humidifying pan.
At the cleaning, take care not transmit the excessive force to the sensor lead wire.

ALARMS, SAFETY, AND SELF-DIAGNOSIS

The incubator supports the following alarms, safety functions, and self-diagnostic functions.

Alarms, safety and self-diagnosis for culture operations

Alarm or safety function	Conditions	Indication	Buzzer	Safety operation
Upper limit temperature alarm	If the chamber temperature exceeds the upper limit alarm temperature set value.	Over heat lamp lights. E12 or E16 and chamber temperature are displayed alternately.	Continuous tone	Heater OFF Remote alarm
Automatic set temperature alarm	If the chamber temperature deviates from the set temperature by ±1°C or more.	All digits on the temperature indicator blink.	Intermittent tone with 15 minutes delay.	Remote alarm with 15 minutes delay
Automatic set CO_2 density alarm	If the chamber CO_2 density deviates from the set value by ±1% or more.	All digits on the digital CO_2 density indicator blink.	Intermittent tone with 15 minutes delay.	Remote alarm with 15 minutes delay
Door check	The outer door is open.	Door lamp lights	-----	Fan motor OFF CO_2 valve is closed UV lamp OFF* (60 seconds after) Heater OFF
Auto-return	When there is no key pressing in each setting mode for 90 seconds.	Normal display mode.	-----	The setting mode is canceled.
Key lock	When the key lock is “ON”.	-----	-----	The setting is disabled.
CO_2 gas cylinder empty	If the CO_2 density does not increase when the gas valve is opened.	E01 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Remote alarm
Gas line changeover	When the gas supply line is switched. (only when MCO-21GC is installed)	E01 is displayed alternately with the temperature on the digital temperature indicator. CO_2 gas supply line indicator of empty blinks.	Intermittent tone	Gas supply line is altered. Remote alarm
Chamber temperature sensor abnormality	If the temperature sensor is disconnected.	E05 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Heater OFF Remote alarm
	If the temperature sensor is short circuited.	E06 is displayed alternately with the temperature on the digital temperature indicator.		
Ambient temperature sensor abnormality	If the ambient temperature sensor is disconnected.	E09 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Remote alarm
	If the ambient temperature sensor is short circuited.	E10 is displayed alternately with the temperature on the digital temperature indicator.		
CO_2 sensor abnormality	If the output voltage of the CO_2 sensor is abnormal.	E11 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	CO_2 valve is closed Remote alarm
Main heater abnormality	If the upper limit alarm temperature alarm operates, or if the main heater is open circuit, or the main heater relay short circuit.	E12 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Remote alarm
Bottom heater abnormality	If the bottom heater goes open circuit, or the bottom heater relay short circuit.	E13 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Remote alarm
Door heater abnormality	If the door heater goes open circuit, or the door heater relay short circuit.	E14 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Remote alarm
Disconnection of sensor for each heater	If the relay of main heater, bottom heater or sensor box heater goes open circuit.	E16 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Remote alarm
Low humidifying Water*	If the water in the humidifying pan is about 0.8 liter.	Water level alarm lamp(RH PAN) blinks.	-----	-----
UV lamp failure*	When the UV lamp is burned out.	E18 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Remote alarm
Recommendation of new UV lamp*	The accumulated ON time is over about 1,000 hrs.	UV indicator blinks when UV lamp is OFF.	-----	-----

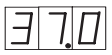
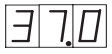
*MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed.

• The alarm can be canceled by pressing the alarm buzzer stop key (BUZZER), but the remote alarm cannot be stopped. And the upper limit temperature alarm cannot be silenced with the alarm buzzer stop key (BUZZER).
• E01 is cleared automatically when the gas is connected correctly and the buzzer is silenced with the alarm buzzer stop key (BUZZER). When MCO-21GC is installed, press the alarm buzzer stop key (BUZZER) to silence the alarm after changeover of gas supply line.
• If one of E05 to E18 (except for E12, E13, and E14) is displayed, contact a Sanyo sales representative or agent.

SETTING OF ALARM RESUME TIME

The alarm buzzer is silenced by pressing alarm buzzer stop key (BUZZER) on the control panel during alarm condition (The remote alarm is not stopped).
The buzzer will be activated again after certain suspension if the alarm condition is continued (The remote alarm continues). The suspension time can be set by following the procedure shown in the table below.
The example in the table is based on the assumption that the desired duration is 20 minutes.
Note: The duration is set in 30 minutes at the factory.

Table Changing procedure for alarm resume time (Ex: change from 30 minutes to 20 minutes)

	Description of operation	Key operated	Indication after operation
1		----	The current chamber temperature is displayed. 
2	Press calibration key for 5 seconds.	CAL	The left digit blinks.
3	Set the figure to F25 with the numerical value shift key and digit shift key.	▲▲	When pressed, the figure of settable digit changes.
		▶▶	The settable digit is shifted.
4	Press enter key.	ENT	The current setting is displayed. The middle digit blinks.
5	Set the figure to 020 with the numerical value shift key.	▲▲	When pressed, the figure of settable digit changes.
6	Press enter key.	ENT	The setting is memorized and the current chamber temperature is displayed. 

• The settable alarm resume time are 0, 10, 20, 30, 40, 50, or 60 minutes (The setting is 000, 010, 020, 030, 040, 050 or 060 respectively). The buzzer would not reset if the reset time is set in 000.
• It is recommended to set the alarm resume time when the incubator is not under alarm condition. The setting during alarm condition is effective on the next alarm condition.
• The setting cannot be changed during power failure.
• The remote alarm during power failure cannot be stopped.
• The set mode returns to the temperature display mode automatically when 90 seconds has passed without any key operation. In this case, any setting before pressing enter key is not memorized.

Pressing calibration key (CAL) for about 5 seconds leads the calibration mode. In the calibration mode, the calibration of temperature and CO_2 density is possible. Wrong key operation affects the basic performance. Never touch any other keys on the control panel in the event of pressing calibration key (CAL) accidentally. After about 90 seconds, the incubator returns to chamber temperature display mode automatically.

Operation after power failure

The set value is memorized by nonvolatile memory. Accordingly, the incubator resumes the operation with setting before power failure.

ROUTINE MAINTENANCE

Cleaning the chamber and inner attachments

When the chamber of the incubator is contaminated, the chamber and internal attachments should be cleaned and sterilized as follows.

⚠WARNING

Before performing any repairs or maintenance, **turn OFF the power switch and unplug the incubator.** Failure to do say may result in electric shock or injury.

Be careful not to inhale chemicals, vapors or aerosols when cleaning the incubator. Doing so may be harmful to health.

⚠CAUTION

Wear rubber gloves when performing maintenance on the chamber. Failure to wear gloves may result in cuts or abrasions from sharp edges or corners.

Note:

Be careful not to damage the water level sensor or the UV lamp in the chamber duct (if the MCO-18AC(UV) or an optional UV system kit MCO-18UVS3 is installed).

Do not use detergents or antiseptic solutions with acid, alkali, or chlorine. Doing so may cause discoloration, corrosion, or rusting.

1. Close the valve of the CO_2 gas cylinder and turn off the power to the incubator.

2. Open the outer door. Remove 2 pins fixing the inner door hinge and remove the inner door.

3. Pull out the all trays. (See Fig. 1.)

4. Lift the front of the tray supports and pull them out. (See Fig. 2.)

5. (MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed)
Lift the humidifying pan cover off from the pins on the rear side. (See Fig. 3.)

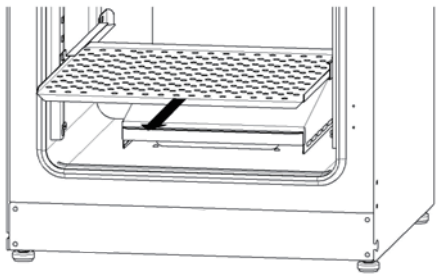


Fig. 1

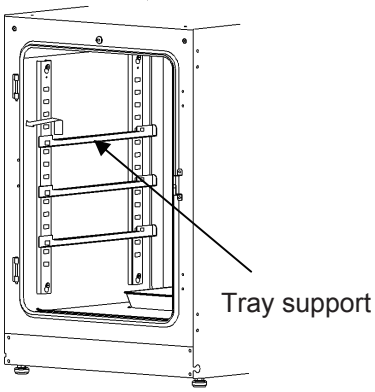


Fig.2

Fig.3

6. Pull out the humidifying pan. (See Fig. 4.)

7. Loosen the two screws securing the fan cover and take off the fan cover. (See Fig. 5.)

8. Lift the duct and remove it from the pins on the rear side. (See Fig. 6.)

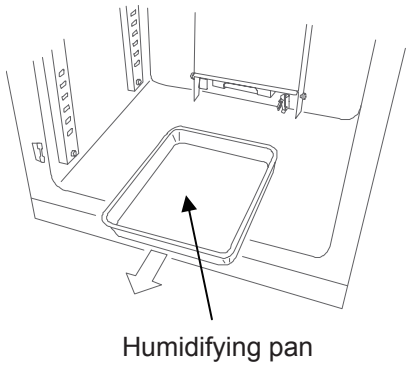


Fig.4

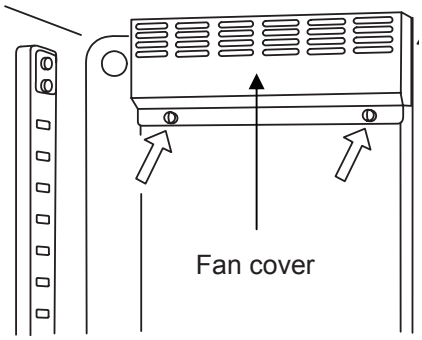


Fig.5

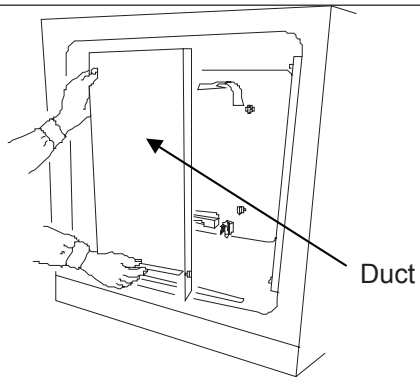


Fig.6

9. Remove the fan by pulling out the central spring and then by pulling out the fan. (See Fig. 7.)

10. Remove the screw securing the clamp for the side support and remove the clamp. (See Fig. 8.)

11. Lift the side support off of the pins. (See Fig. 9.)

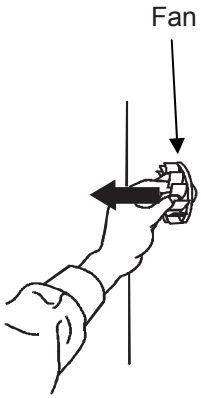


Fig.7

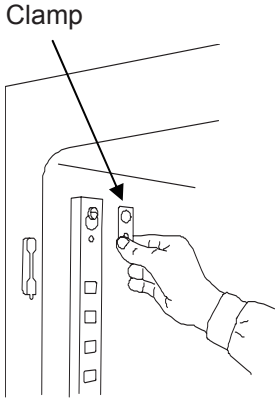


Fig.8

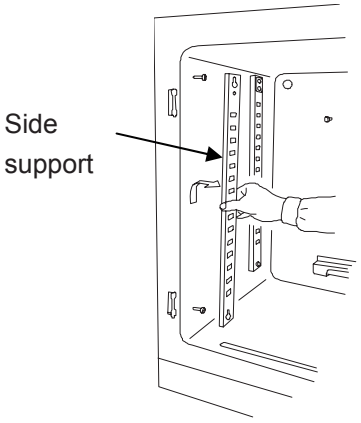


Fig.9

12. Clean all the attachments with a diluted neutral detergent, and then rinse them thoroughly with distilled water.

13. Wipe the trays, the inner attachments such as the fan, and the chamber sides with sterilizing alcohol. Be careful not to leave any residual alcohol.

14. Wipe the inside wall of the chamber with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

15. (MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed)
Wipe the water level sensor with sterilizing alcohol. Be careful not to leave any residual alcohol. When cleaning the sensor, take care not to apply excessive force to the lead wires.

16. To reinstall all the attachments, perform the procedure in reverse order from step 11.

17. Fill the humidifying pan with sterile distilled water.

Note:
• When installing the fan, insert it securely on the motor shaft (See Fig.10). Lightly turn the fan manually to make sure that it does not strike the rear panel. Improper insertion may cause poor performance.
• As shown in Fig. 11, set the tray with only the front edge bent down. If the tray is set in the wrong direction, it may not be level and may become unstable.

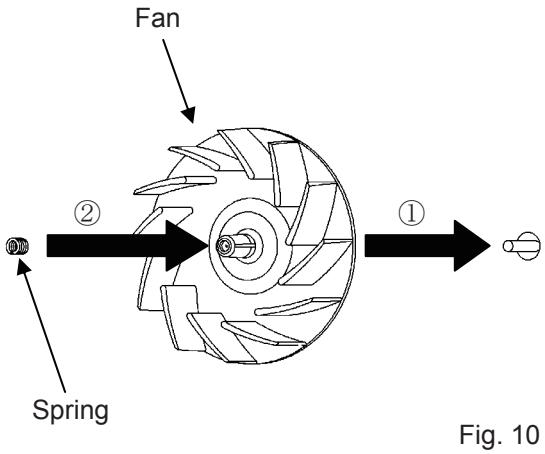


Fig. 10

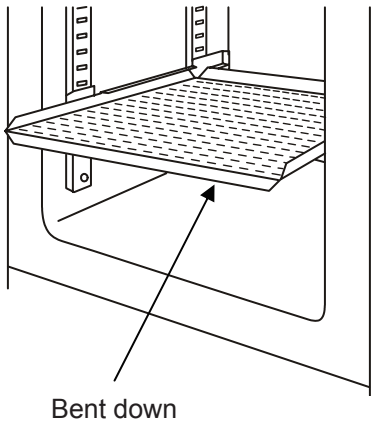


Fig. 11

Filling the humidifying pan

Use the following procedure to fill the humidifying pan or to replace the water.

1. (MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed)Lift the humidifying pan cover. After that pull the humidifying pan forward. (See Fig. 1.)

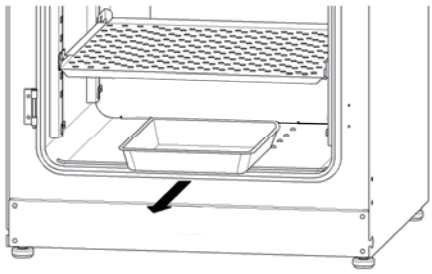


Fig. 1

2. Dispose of the remaining water in the humidifying pan and clean the humidifying pan with a neutral dishwashing detergent. Then rinse it thoroughly with distilled water and wipe it with sterilizing alcohol.

3. Wipe all moisture from the bottom of the chamber.

4. Return the humidifying pan to the chamber and add sterile distilled water (approx. 1.5 L, preheated to 37°C). (See Fig. 2.)

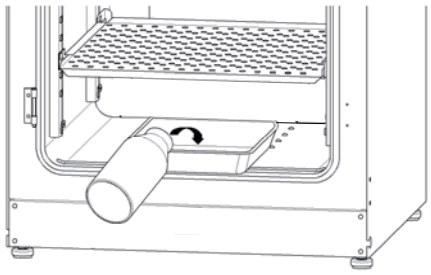


Fig. 2

Note:
Preheat to 37°C the water to be added to the humidifying pan. Adding low-temperature water will lower the temperature and humidity in the chamber.

5. Set the humidifying pan with the inner side flush against the back, and close the inner and outer doors.

(MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed)
Set the humidifying pan with the inner side flush against the back, and replace the humidifying cover (Refer to page 24). Close the inner and outer doors, and confirm that water level alarm lamp (RH PAN) on the control panel is off.

Note:
(MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed)
If the water level alarm lamp(RH PAN) blinks, use the above procedure to replenish the water.

⚠CAUTION

(MCO-18AC(UV) or when an optional UV system kit MCO-18UVS3 is installed)
When refilling the water in the humidifying pan, **always wipe off any dirt from the water level sensor with sterilizing alcohol**. While doing that, be careful not to apply excessive force to the sensor lead wire.

CALIBRATION

Temperature calibration

1. Press the calibration key (CAL) for approximately 5 seconds again to enter the temperature calibration input mode.
2. The left digit of the digital temperature indicator blinks, and the digital CO_2 density indicator goes out.
3. Set the present correct temperature with the digit shift key (▶▶) and numerical value shift key (▲), then press the enter key (ENT).
4. The incubator automatically reverts to the display mode.

[Example]
If the displayed chamber temperature is 37.0°C (set value) and the actual temperature is 36.8°C.
1. Press the calibration key (CAL) for about 5 seconds.
2. The “3” on the digital temperature indicator blinks, and the digital CO_2 density indicator goes out.
3. Adjust the set value to the actual value of 36.8°C with the digit shift key (▶▶) and numerical value shift key (▲), then press enter key (ENT).
4. The incubator automatically reverts to the display mode.

CALIBRATION

CO_2 calibration

Span setting

Span setting should be done under stable condition of temperature, humidity, and CO_2 density.

1. Press the calibration key (CAL) once to enter the CO_2 calibration pre-conditioning mode.

2. Confirm blinking the decimal point in the digital CO_2 density indicator.

3. Open the outer door and remove the sample air outlet cap on the inner door.

4. Measure the CO_2 density in the chamber through the sample air outlet on the inner door.

5. Press the calibration key (CAL) for about 5 seconds again to enter the temperature calibration input mode.

6. The left digit on the digital temperature indicator blinks, and the digital CO_2 density indicator goes out.

7. Press the calibration key (CAL) once again to enter the CO_2 calibration input mode.

8. The left digit on the digital CO_2 density indicator blinks, and the temperature indicator goes out.

9. Set the present correct CO_2 density with the digit shift key (▶▶) and numerical value shift key (▲), then press the enter key (ENT).

10. Replace the sample air outlet cap.

11. The incubator automatically reverts to the display mode.

Note:

This calibration is available when the setting of CO_2 density is 2% or more.

[Example]

For an internal CO_2 density of 5.0% (setting) and a measured value of 4.5%.

1. Press the calibration key (CAL) once.

2. Press the calibration key (CAL) for about 5 seconds again.

3. The “3” on the digital temperature indicator blinks, and the digital CO_2 density indicator goes out.

4. Press the calibration key (CAL) once again.

5. The “0” on the digital CO_2 density indicator blinks, and the digital temperature indicator goes out. The left digit on the digital CO_2 density indicator blinks, and the temperature indicator goes out.

6. Set the present correct CO_2 density (4.5%) with the digit shift key (▶▶) and numerical value shift key (▲), then press the enter key (ENT).

7. The incubator automatically reverts to the display mode.

Note:

It is important to accurately measure the temperature inside the incubator when calibrating the temperature. Particularly, the temperature gauge used must have an accuracy of JIS 0.5 Class or better. The temperature must be measured at several points.

The temperature setting must not change by more than ±1.0°C during calibration. If these values are exceeded, an error buzzer will sound, the input data will be ignored, and the incubator will return to the display mode. If it is necessary to change the temperature by more than 1.0°C, perform calibration in several stages over a period of time.

TROUBLESHOOTING

If the incubator does not seem to be working properly, check the following items before calling for service.

Malfunction	Check/Remedy
The incubator does not operate at all.	• The incubator is not plugged correctly into a power outlet. • The circuit breaker at the power source is active or a power failure has occurred.
The key operation is disable	• The key lock function is set in ON mode.
If the alarm function and the buzzer operates	[At the beginning of operation] • The chamber temperature is not equal to the set value. • The chamber CO_2 density is not equal to the set value. a. The secondary pressure of the pressure regulator is not equal to the set value (0.03MPaG, 0.3kgf/cm^{2}G, 4.3psiG). b. The tube is not connected securely between the pressure regulator and the incubator. [During operation] • The upper limit alarm temperature is not set at least 1°C higher than the set chamber temperature. • The set temperature value was changed, or the door was left open for a long period. Or a low temperature load was placed inside the incubator. In this case, if the incubator is left as it is, the alarm will eventually clear itself. • The gas tube has slipped off or the gas leaks. • The set value of the gas density was changed. • The gas cylinder is empty. Check the primary pressure of the CO_2 cylinder once a week. (The primary pressure of less than 3.8MPaG (38kgf/cm^{2}G) means a little gas in the cylinder. Replace the cylinder soon.)
If the chamber temperature is not equal to the set temperature	• The ambient temperature must always be at least 5°C less than the set temperature. • The outer door was closed while the inner door was left open.
If the CO_2 gas density does not coincide with the set value	• The secondary pressure is not set to 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG). • The gas tube is clogged or chinked. • The humidifying pan is not filled with sterile distilled water. (Always use sterile distilled water.)
If the chamber humidity does not rise	• The humidifying pan is not filled with sterile distilled water. (Always use sterile distilled water.)
If the CO_2 consumption is too much	• The door is opened frequently. • There is any gas leakage at the connection or pin hole on the tube. It is recommended to replace the tube once a year. • The gasket of the inner door is not completely sealed. • The access port at the upper left corner is opened.
If normal cultivation cannot be done and chamber gas density is suspect	• The environment around the incubator is not normal. The source of the contaminated gas is nearby. • The incubator is installed in an enclosed space.
If it takes much time to recover the CO_2 gas density	• HEPA filter is provided in the gas piping. If it takes much time to recover the gas density even though the gas pressure is normal, it may be that dust on the HEPA filter prevents the gas flow. Contact a Sanyo sales representative or agent.
CO_2 gas is not being injected.	• The CO_2 control method for the incubator is the ON-OFF method. CO_2 gas is intermittently injected as the gas concentration in the chamber approaches the set value. Injections may be stopped for periods of approximately 15 seconds, but that is not an error.

Note: If the problem still has not been solved after trying the above checks and countermeasures, or for any problems not covered here, contact a Sanyo sales representative or agent.

DISPOSING OF THE CO_2 INCUBATOR

When disposing of the CO_2 incubator, contact a Sanyo sales representative or agent.

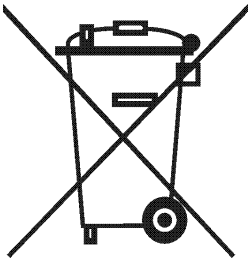
⚠WARNING

The incubator must be dismantled and disposed of by qualified personnel only. If the incubator is left where outsiders enter, it may result unexpected accident (for example, children to become locked inside).

Before disposing a CO_2 incubator with biohazardous danger, decontaminate the CO_2 incubator to the extent possible by the user.

Note:
This symbol mark and recycle system are applied only to EU countries and not applied to the countries in the other area of the world.

Waste Electrical and Electronic Equipment (WEEE) Directive-2002/96/EC



(English)
Your SANYO product is designed and manufactured with high quality materials and components which can be recycled and reused.

This symbol means that electrical and electronic equipment, at their end-of-life, should be disposed of separately from your household waste.

Please dispose of this equipment at your local community waste collection/recycling centre.

In the European Union there are separate collection systems for used electrical and electronic products.

Please help us to conserve the environment we live in!

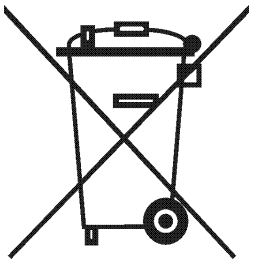
(German)
Ihr SANYO Produkt wurde entworfen und hergestellt mit qualitativ hochwertigen Materialien und Komponenten, die recycelt und wiederverwendet werden können.

Dieses Symbol bedeutet, daß elektrische und elektronische Geräte am Ende ihrer Nutzungsdauer von Hausmüll getrennt entsorgt werden sollen.

Bitte entsorgen Sie dieses Gerät bei Ihrer örtlichen kommunalen Sammelstelle oder im Recycling Centre.

In der Europäischen Union gibt es unterschiedliche Sammelsysteme für Elektrik- und Elektronikgeräte.

Helfen Sie uns bitte, die Umwelt zu erhalten, in der wir leben!



(French)
Votre produit Sanyo est conçu et fabriqué avec des matèriels et des composants de qualité supérieure qui peuvent être recyclés et réutilisés.

Ce symbole signifie que les équipements électriques et électroniques en fin de vie doivent être éliminés séparément des ordures ménagères.

Nous vous prions donc de confier cet équipement à votre centre local de collecte/recyclage.
Dans l'Union Européenne, il existe des systèmes sélectifs de collecte pour les produits électriques et électroniques usagés.

Aidez-nous à conserver l'environnement dans lequel nous vivons !

Les machines ou appareils électriques et électroniques contiennent fréquemment des matières qui, si elles sont traitées ou éliminées de manière inappropriée, peuvent s'avérer potentiellement dangereuses pour la santé humaine et pour l'environnement.
Cependant, ces matières sont nécessaires au bon fonctionnement de votre appareil ou de votre machine. Pour cette raison, il vous est demandé de ne pas vous débarrasser de votre appareil ou machine usagé avec vos ordures ménagères.

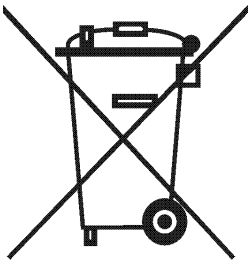
(Spanish)
Los productos SANYO están diseñados y fabricados con materiales y componentes de alta calidad, que pueden ser reciclados y reutilizados.

Este símbolo significa que el equipo eléctrico y electrónico, al final de su ciclo de vida, no se debe desechar con el resto de residuos domésticos.

Por favor, deposite su viejo "televisor" en el punto de recogida de residuos o contacte con su administración local.

En la Unión Europea existen sistemas de recogida específicos para residuos de aparatos eléctricos y electrónicos.

Por favor, ayúdenos a conservar el medio ambiente!



(Portuguese)
O seu produto SANYO foi concebido e produzido com materiais e componentes de alta qualidade que podem ser reciclados e reutilizados.

Este símbolo significa que o equipamento eléctrico e electrónico no final da sua vida útil deverá ser descartado separadamente do seu lixo doméstico.

Por favor, entregue este equipamento no seu ponto local de recolha/reciclagem.

Na União Europeia existem sistemas de recolha separados para produtos eléctricos e electrónicos usados.

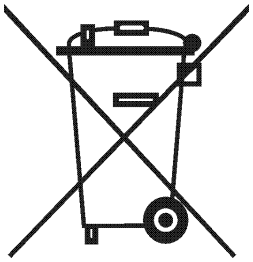
Por favor, ajude-nos a conservar o ambiente em que vivemos!

(Italian)
Il vostro prodotto SANYO è stato costruito da materiali e componenti di alta qualità, che sono riutilizzabili o riciclabili.

Prodotti elettrici ed elettronici portando questo simbolo alla fine dell'uso devono essere smaltiti separatamente dai rifiuti casalinghi.

Vi preghiamo di smaltire questo apparecchio al deposito comunale.
Nell'Unione Europea esistono sistemi di raccolta differenziata per prodotti elettrici ed elettronici.

Aiutateci a conservare l'ambiente in cui viviamo!



(Dutch)
Sanyo producten zijn ontwikkeld en gefabriceerd uit eerste kwaliteit materialen, de onderdelen kunnen worden gerecycled en weer worden gebruikt.

Het symbool betekent dat de elektrische en elektronische onderdelen wanneer deze vernietigd gaan worden , dit separaat gebeurt van het normale huisafval.

Zorg ervoor dat het verwijderen van de apparatuur bij de lokaal erkende instanties gaat gebeuren.
In de Europese Unie wordt de gebruikte elektrische en elektronische apparatuur bij de daarvoor wettelijke instanties aangeboden.

Alstublieft help allen mee om het milieu te beschermen.

(Swedish)
Din SANYO produkt är designad och tillverkad av material och komponenter med hög kvalitet som kan återvinnas och återanvändas.

Denna symbol betyder att elektriska och elektroniska produkter, efter slutanvändande, skall sorteras och lämnas separat från Ditt hushållsavfall.

Vänligen, lämna denna produkt hos Din lokala mottagningstation för avfall/återvinningsstation.

Inom den Europeiska Unionen finns det separata återvinningssystem för begagnade elektriska och elektroniska produkter.

Vänligen, hjälp oss att bevara miljön vi lever i!

AUTOMATIC CO_2 CYLINDER CHANGEOVER

An automatic CO_2 cylinder changeover system (MCO-21GC) is available as an optional accessory. This system switches the gas supply line when one CO_2 gas cylinder is empty.
Note: The installation of the MCO-21GC must be performed only by qualified service personnel.

Install the MCO-21GC and then perform the following procedure

1. Connect the CO_2 gas pipes to connecting ports for CO_2 gas pipes A and B. Connecting ports for CO_2 gas pipes are located on the left back of the incubator. (Refer to page 8).
Note: Only port A can be used when the MCO-21GC is not installed. There will be 2 ports, ports A and B, after the MCO-21GC is installed.

2. Connect a CO_2 gas cylinder equipped with a gas pressure regulator to each gas pipe. Refer to page 14 for information on connecting the CO_2 gas cylinders. ("Gas cylinder A" is the CO_2 gas cylinder connected to the CO_2 gas pipe connected to port A, and "gas cylinder B" is the CO_2 gas cylinder connected to the CO_2 gas pipe connected to port B.)

3. Open the valve of both gas cylinders.

4. Check that the CO_2 gas supply line indicator on the control panel is lit by pressing the CO_2 gas supply line switching key.

5. Select a CO_2 gas supply line (A or B).

6. The MCO-21GC detects that there is no more CO_2 gas in a cylinder when the CO_2 density in the chamber does not increase for a while even after opening the CO_2 gas valve in the incubator. It switches the gas supply line when it detects that there is no more gas. At that time, the following indications of switching the gas cylinder are provided.

Digital temperature indicator	Buzzer	CO_2 gas supply line indicator	
		Empty line	The other line
E01 is displayed alternately with the temperature on the digital temperature indicator.	Intermittent tone	Blinks	Lights

●To silence the buzzer, press the alarm buzzer stop key (BUZZER). The alarm condition is cleared and normal operation continues.

7. When gas cylinder A is switched to B, remove gas cylinder A and replace it with new one.
Note: Be careful when handling the empty CO_2 gas cylinder. Some gas may still be left in the cylinder.

8. When gas cylinder B becomes empty, the line is switched to gas cylinder A again.

The MCO-21GC detects that there is no more CO_2 gas in a cylinder when the CO_2 density in the chamber does not increase for a while even after opening the CO_2 gas valve in the incubator. The supply line may also be switched for other reasons even though there is gas left in the cylinder: blocking or restricting of gas tube, reduction of CO_2 gas pressure, or improper opening of CO_2 gas cylinder. Always check the gas quantity in the cylinder before disconnecting it.

STACKING INCUBATORS

Use the following procedure to stack incubators. This work is potentially dangerous, so contact a Sanyo sales representative or agent.

⚠CAUTION

- **Select a floor that is strong enough to support the stacked incubators.**
- **Never stack three or more incubators.** Doing so is dangerous.

1. Take out two stacking plates A, two stacking plates B, four protective stickers, and four screws from accessory bag.

Note:

When stacking two incubators, **use two stacking plates (A and B) for each one**. Only one pair of stacking plates is provided per incubator, so take out the stacking plates (A and B) from both incubators. Similarly only 2 protective stickers are provided per incubator

2. Unplug both of the incubators that are to be stacked.

3. Remove the caps at the two places in the front of the top surface of the incubator that is to be on the bottom, and attach the protective stickers to the four corners on the top surface of the incubator that is to be on the bottom. (See Fig. A. on the page 41)

4. Secure stacking plates A with the screws that are provided.

5. Remove the front panel (4 screws) from the incubator that is to be on the top.

6. Place the upper incubator on top of the lower one, being careful not to pinch your fingers.

7. Make the lower incubator level by adjusting the leveling feet, and then level the upper incubator in the same way.

8. Secure stacking plates A on the top surface of lower incubator to the upper one with the accessory screws.

9. Remove from the back of the lower incubator the two hooks (4 screws) and remove from the upper incubator the 2 screws on the lower rear panel.

10. Use the 6 screws that were removed in step 9 to secure stacking plates B to the rear panels of the upper and lower incubators.

11. Replace the front panel (4 screws) to the upper incubator.

12. Use the hooks on the back of the upper incubator to prevent the incubators from falling over.

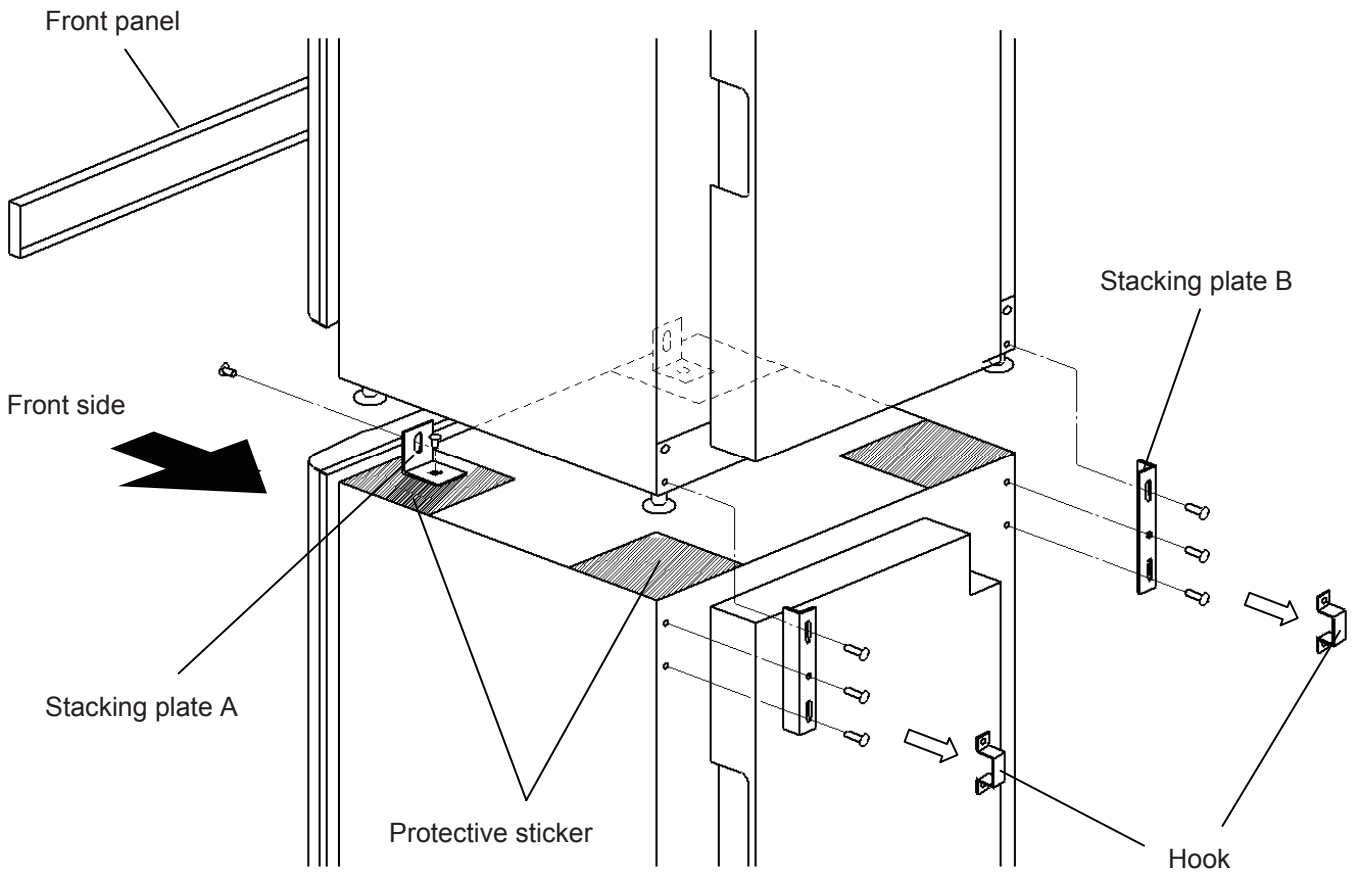

Front panel
Stacking plate B
Front side
Stacking plate A
Protective sticker
Hook

Fig.A

SPECIFICATIONS

Name	CO_2 incubator	
Model	MCO-18AC	MCO-18AC(UV)
External dimensions	W620 x D710 x H900 (mm)	
Internal dimensions	W490 x D523x H665 (mm)	
Interior volume	170 L	
Exterior	Painted steel	
Interior	Stainless steel containing copper	
Outer door	Painted steel	
Inner door	Tempered glass	
Tray	3 trays made of stainless steel containing copper W450 x D450 x H12 (mm), Maximum load; 7 kg/tray	
Access port	Inner diameter; 30 mm, On the back side	
Insulation	Rigid polyurethane foamed-in place	
Heating system	DHA system (heater jacket + air jacket system)	
Heater	282 W	
Humidifying system	Natural evaporation with humidifying pan	
Temperature controller	PID control system	
Temperature display	Digital display	
CO_2 controller	ON-OFF control system/TC sensor	
CO_2 density display	Digital display	
Air circulation	Fan assisted	
Air filter	0.3 μm, Efficiency; 99.97% or more	
UV lamp	-----	4W X 1 (ozone-free emission)
Water level sensor	-----	Optical type
Alarm	-----	UV lamp failure alarm Low humidifying water alarm
	Automatic set temperature alarm, Automatic set CO_2 density alarm Upper limit temperature alarm, various gas/sensor/heater alarms	
Remote alarm contact	Allowable contact capacity: DC 30 V, 2 A	
CO_2 inlet connection	4 to 6 mm diameter tube can be connected	
CO_2 inlet pressure	0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG)	
Accessories	3 trays, 3 sets of tray support, 1 gas tube, 1 humidifying pan, Stacking plate A and B, 2 protective stickers, 2 tube bands	
Weight	92 kg	93 kg
Optional accessory	UV system kit (MCO-18UVS3)	Standard equipment
	UV replacement kit (MCO-20UV), 4-20mA Interface(MCO-420MA, USA only) Gas pressure regulator (MCO-100L) Extra tray (MCO-47ST) including 2 tray supports, Half tray (MCO-25ST) Automatic CO_2 cylinder changeover system (MCO-21GC), Roller base (MCO-18RB) RS232C/RS485 Interface (MTR-480), Ethernet (LAN) Interface (MTR-L03) SANYO Data acquisition software (MTR-5000)	

Note: Design or specifications will be subject to change without notice.

PERFORMANCE

Temperature control range	Ambient temperature +5°C to 50°C (ambient temperature; 5°C to 35°C)		
Temperature distribution	± 0.25°C (ambient temperature; 25°C, setting; 37°C, CO_2 5%, no load)		
Temperature variation	± 0.1°C (ambient temperature; 25°C, setting; 37°C, CO_2 5%, no load)		
CO_2 control range	0 to 20%		
CO_2 variation	± 0.15% (ambient temperature; 25°C, setting; 37°C, CO_2 5%, no load)		
Chamber humidity	95 ± 5%RH		
Heat emission	Max. 1116 kJ/h		
Applicable environment condition	Temperature: 5°C to 35°C, Humidity: equal or less than 80% R.H. (The designed performance may not be obtained when the ambient temperature is equal or less than 15°C)		
Noise level	24 dB (A scale)		
Power consumption	Max. 300 W	Max. 310 W	
Rated voltage, frequency	110 to 120 V, 60 Hz	220 V, 60 Hz	220 to 240 V, 50 Hz
Amperage	Max. 2.6 A	Max. 1.4 A	Max. 1.4 A

Note: The unit with CE mark complies with EC directives.
It is based on our measuring method.

⚠ CAUTION

Please fill in this form before servicing.
Hand over this form to the service engineer to keep for his and your safety.

Safety check sheet

1. Incubator contents : ☐Yes ☐No
   Risk of infection: ☐Yes ☐No
   Risk of toxicity: ☐Yes ☐No
   Risk from radioactive sources: ☐Yes ☐No

   (List all potentially hazardous materials that have been stored in this unit.)
   Notes :

2. Contamination of the unit
   Unit interior ☐Yes ☐No
   No contamination ☐Yes ☐No
   Decontaminated ☐Yes ☐No
   Contaminated ☐Yes ☐No
   Others:

3. Instructions for safe repair/maintenance of the unit
   a) The unit is safe to work on ☐Yes ☐No
   b) There is some danger (see below) ☐Yes ☐No
   Procedure to be adhered to in order to reduce safety risk indicated in b) below.

Date :
Signature :
Address, Division :
Telephone :

Product name :	Model :	Serial number :	Date of Installation :
CO_2 incubator	MCO-18AC MCO-18AC(UV)		

Please decontaminate the unit yourself before calling the service engineer.

SANYO Electric Co., Ltd
Printed in Japan